Monitoring Report
Year 3
FINAL
Little Buffalo Creek Stream Mitigation Project

NCDEQ-DMS Project Number: 94147
Contract Number: 2029
USACE Permit Action ID: 2014-00386
DWR Permit: 14-0129
Cabarrus County

Data collection: September/November 2017
Draft Submitted: December 2017
Final Submitted: February 2018

Prepared for:

North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Prepared by:

Louis Berger

Louis Berger
1001 Wade Avenue, Suite 400
Raleigh, North Carolina 27605
Tel (919) 866-4400
Fax (919) 755-3502

Project Manager:
Robin Maycock
Tel (919) 866-4428
Fax (919) 755-3502
RMaycock@louisberger.com

Environmental Quality

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

February 5, 2018

Robin Maycock
Project Manager
Louis Berger
1001 Wade Avenue
Suite 400
Raleigh, NC 27605

Subject: DRAFT Monitoring Year 3 report for the
Little Buffalo Creek Stream Mitigation Project
Yadkin River Basin – CU# 03040105– Cabarrus County
DMS Project ID No. 94147
Contract # 002029

Dear Mrs. Maycock:

On January 3, 2018, the Division of Mitigation Services (DMS) received the DRAFT Monitoring Year 3 report for the Little Buffalo Creek Stream Mitigation Project site from Louis Berger. The report establishes the year 3 monitoring conditions at the site. Anticipated mitigation on the site includes 2,017 linear feet of stream restoration; 1,244 linear feet of stream Enhancement (Level I); 7,723 linear feet of stream Enhancement (Level II); and 2,378 linear feet of stream Preservation for a total of 6,411 Stream Mitigation Units (SMUs).

General: DMS has concerns about the stream mitigation assets on UT 2, UT 3 and UT 5 and believes that these assets may be "at risk" due to lack of flow and/ or silting. DMS recommends scheduling an IRT site visit to see the site in early 2018 (MY4) to resolve any potential credit issues on the site prior to project closeout. DMS will help facilitate this IRT site visit request upon receipt of the final MY3 report. DMS requests that Louis Berger not invoice for MY3 until the IRT site visit has been completed and IRT comments have been received.

Cover: Please update the USACE Permit Action ID to 2014-00386 on the report cover page.

General: Please print the final report hard copies double sided (if possible) to reduce the size of the report hard copies.

1.2 Project Goals: The goal of providing a safe and environmentally appropriate stream crossing for the livestock is at risk due to the fencing integrity concerns at the crossing. Please take the necessary steps to insure this goal is met.

The goal of excluding the cattle from the stream and riparian corridor is not being met due to the presence of cattle in the easement. Please provide all measures necessary to accomplish this goal.

The objective of removing the invasive vegetative species from the riparian corridor is not being adequately accomplished. Please correct this issue to achieve the goal.

Section 1.5.1 Vegetation Assessment: Please discuss the success of the planted stems in the vegetation plots and then discuss the success of the vegetation plots when volunteers are included. Please also discuss the volunteer species/ volunteer diversity identified on the site. Lastly, please discuss the site's overall vegetative success for planted stems and the sites overall vegetative success when volunteers are included. The success criteria on the site is based on the survival of the planted stems; however, in the past, the IRT has been willing to consider volunteers at project closeout when determining the success of the site's vegetation.

Low stem density areas were noted on the project site during a November 29, 2017 DMS site visit. The report indicates that additional soil treatment and an additional site planting will be performed in the fall of 2018 (the end of MY4). Please note that the IRT may require additional vegetation monitoring (post MY5) if numerous supplemental plantings have been conducted during the monitoring term. Vegetation success is generally based on the initial planting and limited supplemental planting in the early monitoring years. Please explain why supplemental planting is being delayed an entire growing season when it could be accomplished in early 2018.

Section 1.5.2 Stream Assessment: As noted in the MY3 report, beaver dams and invasive species were observed on the site during a November 29, 2017 DMS site visit. Beaver should be trapped and the associated dams removed through project closeout. Additionally, invasive plant species should be treated site wide through project closeout. Some of the previously treatment appear to have had little effect on the invasive vegetation. Please insure effective invasive treatment methods are used so that the objective can be achieved.

Section 1.5.2 Stream Assessment: Please continue to monitor stream flow gauges on the intermittent reaches on the project site as was conducted in MY3. The report notes that an additional stream flow gauge will be install on UT5. This additional gauge should be installed at least half way up the reach. The IRT has noted that project channels that are determined to be non-jurisdictional will not be eligible to receive mitigation credit at project closeout.

Section 1.5.3 Site Boundary Assessment: Significant livestock encroachment was reported in the MY1 & MY2 reports. Additionally, DMS observed livestock encroachment during a November 29, 2017 (MY3) site visit. Please note that failure to document and rectify conservation easement encroachments may lead to reduced project credit and/ or additional monitoring required by the IRT prior to project closeout. DMS property staff is willing to provide assistance enforcing the recorded conservation easement if requested.

Section 1.5.3 Site Boundary Assessment: The project landowners should be informed and understand that all fence maintenance will be the landowner's responsibility when Louis Berger closes the project with DMS and the IRT. Failure to maintain the integrity of the conservation easement may result in legal action from NCDEQ – Stewardship.

Section 1.5.3 Site Boundary Assessment: Is the current easement inspection schedule adequate to protect the assets given the history of cattle damage? Please adjust the frequency if it is determined appropriate.

Section 2.3 Cross-Sections: Consider adding supplemental cross-sections at the repair areas to demonstrate channel response. Please identify all repair areas clearly on a map.

Section 2.5 Hydrological Monitoring: Please include a brief methodology describing how base level stream flow is being documented on the various project reaches.

Figure A1: Table 1 Stream Mitigation By Reach Figure: Please amend or replace the figure. This figure is typically called the "Project Components Map". The project streams should be shown and colored as "Stream Restoration"; "Stream Enhancement (Level I)"; "Stream Enhancement (Level II)"; "Stream Preservation" and "No Credit" with different colors to represent each approach on the map and in the legend. Please be sure to include the conservation easement shape and crossing cutouts on the map. All project reaches and UT #s should be labeled on the map but stationing is not required as it is included in Table 1. GIS shapefiles should be updated accordingly and included in the required MY3 support files.

Table 2: Please include estimated dates for MY4 project activities that are proposed but have not been completed yet.

Table 5 – UT 2: During a November 29, 2017 site visit, DMS noted areas of aggradation on UT 2. The report verbiage notes 30 feet of aggradation on UT 2, but it is not captured in the Table. Please update Table 5 – UT 2 accordingly. Please also confirm the length of aggradation as DMS noted more than 30 feet during the site visit.

Table 6 – A-I & CCPV Sheets: Microstegium is not considered an invasive species of concern. Please remove it from the CCPV sheets and table calculations accordingly.

Table 6 Vegetation Condition Assessment: Please show all footnotes or remove the red footnote/ guidance numbers shown on the table.

Cross Sections / Cross Section Tables – A couple of methods are currently being utilized to calculate the BHR from year to year. To compare subsequent monitoring years to the As-built condition one can hold the bankfull depth static (denominator) while allowing the Low TOB max depth (numerator) to vary. Another method that has been proposed and is being evaluated is to hold the As-built cross sectional area static within each year's new cross section and allow that to determine the max bankfull depth for each year. However; if there are large changes in the W/D ratio either method can make for somewhat distorted BHR values depending upon the direction and magnitude of the change in the W/D ratio. Please update the calculations to reflect changes observed in the overlays and explain in detail as a table footnote how the calculations were made. Be prepared to defend the method used and be able to justify through context whether or not any changes observed in a cross section represent a project issue.

Longitudinal Profiles: The Mainstem Reach 1 Longitudinal Profile water surface data needs to be evaluated and corrected. Trendlines should not be used on water surface plots for any of these profiles, please correct with a simple line connecting the points.

Cross-Sections: The large adjustments to the bankfull elevation in the UT3 cross-sections provide an incomparable reference for assessing aggradation within the reach. Please provide detailed explanation predicting future channel response at these aggraded sections and describe any proposed measures such as possible grade control structures to maintain this aggraded material and insure a more predictable outcome. Update the geomorphic tables to reflect the decreased cross-sectional areas following the aggradation.

Cross-Sections: Top of Rebar is shown in the cross-section legends but some of the cross-section data lines do not extend to the cross-section monuments (rebar). Please provide all cross-section data in the graphs to confirm that annual cross sections are aligned properly. If no additional data is available, please explain why the cross sections do not have the same start and end point associated with the rebar monuments.

Please provide an electronic comment response letter addressing the DMS comments received. This comment response letter should also be included in the FINAL MY3 revised report after the report cover.

Please submit three (3) final hard copies and an electronic copy on CD to my attention at the address below (DMS western field office). Please include all MY 3 project support files on the CD deliverable. The final electronic monitoring report with all attachments should be named:
Little Buffalo Creek_94147_MY3_2017.pdf

If you have any questions, please contact me at any time at (828) 273-1673 or email me at paul.wiesner@ncdenr.gov .

Sincerely,

Paul Wiesner

Paul Wiesner
Western Regional Supervisor
NCDEQ – Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801
(828)273-1673 Mobile

cc: file

February 22, 2018

Mr. Paul Weisner
Western Project Management Supervisor
NCDEQ – Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: DRAFT Monitoring Year 3 report for the
Little Buffalo Creek Stream Mitigation Project
Yadkin River Basin – CU# 03040105 – Cabarrus County
DMS Project ID No. 94147
Contract # 002029

Dear Mr. Weisner:

Louis Berger has reviewed your comments, received on December 11, 2017, for the DRAFT Monitoring Year 3 report for the Little Buffalo Creek Stream Mitigation Project site. We offer the following responses.

- **General:** DMS has concerns about the stream mitigation assets on UT 2, UT 3 and UT 5 and believes that these assets may be "at risk" due to lack of flow and/ or silting. DMS recommends scheduling an IRT site visit to see the site in early 2018 (MY4) to resolve any potential credit issues on the site prior to project closeout. DMS will help facilitate this IRT site visit request upon receipt of the final MY3 report. DMS requests that Louis Berger not invoice for MY3 until the IRT site visit has been completed and IRT comments have been received.
    - *As recommended, Louis Berger will coordinate a site meeting with DMS and the IRT following submission of the final report to discuss these and other project component issues that may be addressed to provide the required mitigation credits for the project.*

- **Cover:** Please update the USACE Permit Action ID to 2014-00386 on the report cover page.
    - *USACE Permit Action ID changed from 2014-0386 to 2014-00386.*

- **General:** Please print the final report hard copies double sided (if possible) to reduce the size of the report hard copies.
    - *Final report hard copies will be printed double sided.*

- **1.2 Project Goals:** The goal of providing a safe and environmentally appropriate stream crossing for the livestock is at risk due to the fencing integrity concerns at the crossing. Please take the necessary steps to insure this goal is met.

- *Louis Berger will continue to work with the landowners and our fencing contractor to ensure that the cattle fencing around the crossing area is properly maintained and any modifications necessary to exclude cattle are installed.*

The goal of excluding the cattle from the stream and riparian corridor is not being met due to the presence of cattle in the easement. Please provide all measures necessary to accomplish this goal.

- *Louis Berger will continue to work with the landowners and our fencing contractor to ensure cattle fencing is maintained and that cattle are kept out of the riparian corridor.*

The objective of removing the invasive vegetative species from the riparian corridor is not being adequately accomplished. Please correct this issue to achieve the goal.

- *Some mature trees within the corridor that were not previously noted were identified during the September and November assessment. These trees will be treated with herbicide application, along with continued application to known invasive trees and shrubs that have yet to succumb to prior treatment, during spring 2018 in accordance with NC Department of Agriculture rules and regulations.*

- **Section 1.5.1 Vegetation Assessment:** Please discuss the success of the planted stems in the vegetation plots and then discuss the success of the vegetation plots when volunteers are included. Please also discuss the volunteer species/ volunteer diversity identified on the site. Lastly, please discuss the site's overall vegetative success for planted stems and the sites overall vegetative success when volunteers are included. The success criteria on the site is based on the survival of the planted stems; however, in the past, the IRT has been willing to consider volunteers at project closeout when determining the success of the site's vegetation.
  - *Section 1.5.1 was divided into subsections to discuss planted stems, combined planted/volunteer stems, and volunteer species/volunteer diversity.*

Low stem density areas were noted on the project site during a November 29, 2017 DMS site visit. The report indicates that additional soil treatment and an additional site planting will be performed in the fall of 2018 (the end of MY4). Please note that the IRT may require additional vegetation monitoring (post MY5) if numerous supplemental plantings have been conducted during the monitoring term. Vegetation success is generally based on the initial planting and limited supplemental planting in the early monitoring years. Please explain why supplemental planting is being delayed an entire growing season when it could be accomplished in early 2018.

- *This region of the State tends to have hot, dry summers that are not conducive to planting trees and is stressful on newly planted trees, as exhibited by the previous supplemental plantings that have had limited success. A myriad of NC agencies and groups recommend planting trees in the fall season due to the area's typical mild winters with wetter conditions which are more conducive to tree survival. Louis Berger recommends following the guidelines of these NC agencies and groups and plant the trees in the fall season in order to increase the survival rates.*

- **Section 1.5.2 Stream Assessment:** As noted in the MY3 report, beaver dams and invasive species were observed on the site during a November 29, 2017 DMS site visit. Beaver should be trapped and the associated dams removed through project closeout. Additionally, invasive plant species should be treated site wide through project closeout. Some of the previously treatment appear to have had little effect on the invasive vegetation. Please insure effective invasive treatment methods are used so that the objective can be achieved.
    - *Louis Berger will implement additional invasive treatments this spring, as well as trap and remove beavers from the site. Dam's will be removed by hand, following the trapping of the beavers.*

- **Section 1.5.2 Stream Assessment:** Please continue to monitor stream flow gauges on the intermittent reaches on the project site as was conducted in MY3. The report notes that an additional stream flow gauge will be installed on UT5. This additional gauge should be installed at least half way up the reach. The IRT has noted that project channels that are determined to be non- jurisdictional will not be eligible to receive mitigation credit at project closeout.
    - *Noted. Louis Berger will install the additional gauge at a minimum of half way up the UT5 reach on our upcoming schedule site visit to record flow, as well as maintain the log for continuous base flow in these intermittent reaches.*

- **Section 1.5.3 Site Boundary Assessment:** Significant livestock encroachment was reported in the MY1 & MY2 reports. Additionally, DMS observed livestock encroachment during a November 29, 2017 (MY3) site visit. Please note that failure to document and rectify conservation easement encroachments may lead to reduced project credit and/ or additional monitoring required by the IRT prior to project closeout. DMS property staff is willing to provide assistance enforcing the recorded conservation easement if requested.
    - *Noted. Louis Berger will continue to monitor for encroachment and work with the landowners. In addition, Louis Berger is reaching out to the farm hands renting the property and maintaining the herd of cattle located in the properties adjacent to the project site. Louis Berger will coordinate with DMS property staff for future enforcement of the conservations easement if the issue is not rectified immediately.*

- **Section 1.5.3 Site Boundary Assessment:** The project landowners should be informed and understand that all fence maintenance will be the landowner's responsibility when Louis Berger closes the project with DMS and the IRT. Failure to maintain the integrity of the conservation easement may result in legal action from NCDEQ – Stewardship.
    - *Noted. Louis Berger will re-iterate this information to the landowners in our on-going negotiations for cattle encroachment on the easement.*

- **Section 1.5.3 Site Boundary Assessment:** Is the current easement inspection schedule adequate to protect the assets given the history of cattle damage? Please adjust the frequency if it is determined appropriate.
    - *Louis Berger will be increasing the frequency of site visits to monitor for encroachment as needed. Currently, it seems the ongoing encroachment issue pertains to isolated cattle escaping into the easement by way of the cattle*

crossing. Louis Berger will continue to work with the landowners and our fencing contractor to ensure that the cattle fencing around the crossing area is properly maintained and any modifications necessary to exclude cattle are installed. Should issues with encroachment continue, DMS will be notified for aid in enforcing the conservation easement.

- **Section 2.3 Cross-Sections:** Consider adding supplemental cross-sections at the repair areas to demonstrate channel response. Please identify all repair areas clearly on a map.
    - *Repair areas have been included in the MY3 CCPV map. A cross-section exists (MS2R) along the major repair area within the site. Additional sections may be added during the MY4 survey and will be decided following the meeting with the IRT.*

- **Section 2.5 Hydrological Monitoring:** Please include a brief methodology describing how base level stream flow is being documented on the various project reaches.
    - *A brief description on the method for documenting base flow has been included in Section 2.5 of the MY3 Final report.*

- **Figure A1:** Table 1 Stream Mitigation by Reach Figure: Please amend or replace the figure. This figure is typically called the "Project Components Map". The project streams should be shown and colored as "Stream Restoration"; "Stream Enhancement (Level I)"; "Stream Enhancement (Level II)"; "Stream Preservation" and "No Credit" with different colors to represent each approach on the map and in the legend. Please be sure to include the conservation easement shape and crossing cutouts on the map. All project reaches and UT #s should be labeled on the map but stationing is not required as it is included in Table 1. GIS shapefiles should be updated accordingly and included in the required MY3 support files.
    - *This figure has been amended as described.*

- **Table 2:** Please include estimated dates for MY4 project activities that are proposed but have not been completed yet.
    - *Table 2 has been updated with estimated dates for maintenance activities in MY4..*

- **Table 5 – UT 2**: During a November 29, 2017 site visit, DMS noted areas of aggradation on UT 2. The report verbiage notes 30 feet of aggradation on UT 2, but it is not captured in the Table. Please update Table 5 – UT 2 accordingly. Please also confirm the length of aggradation as DMS noted more than 30 feet during the site visit.
    - *The assessment for Table 5 to date has only included the portions of restoration and enhancement level I. The area of aggradation is within a portion of enhancement level II, and thus not included within this table. A footnote has been added to identify this area of aggradation within UT2 on Table 5. The exact distance will be measured in field this spring with the IRT to understand the exact credit generation possibilities of this area based on the wetland characteristics it shows.*

- **Table 6 – A-I & CCPV Sheets:** Microstegium is not considered an invasive species of concern. Please remove it from the CCPV sheets and table calculations accordingly
    - *Microstegium has been removed from Table 6 and the CCPV sheets as requested.*

- **Table 6 Vegetation Condition Assessment:** Please show all footnotes or remove the red footnote/ guidance numbers shown on the table.
    - *Footnotes have been removed from Table 6 as requested.*

- **Cross Sections / Cross Section Tables:** A couple of methods are currently being utilized to calculate the BHR from year to year. To compare subsequent monitoring years to the As-built condition one can hold the bankfull depth static (denominator) while allowing the Low TOB max depth (numerator) to vary. Another method that has been proposed and is being evaluated is to hold the As-built cross sectional area static within each year's new cross section and allow that to determine the max bankfull depth for each year. However; if there are large changes in the W/D ratio either method can make for somewhat distorted BHR values depending upon the direction and magnitude of the change in the W/D ratio. Please update the calculations to reflect changes observed in the overlays and explain in detail as a table footnote how the calculations were made. Be prepared to defend the method used and be able to justify through context whether or not any changes observed in a cross section represent a project issue.
    - *BHR has been calculated with the first method described above by DMS. These values have been corrected for MY1, MY2 and MY3 and updated in all tables and cross-section figures. The method of keeping max bankfull depth static while adjusting for a change in the low top of bank depth was chosen due to the approach DMS prefers of maintaining a consistent baseline bankfull elevation to monitor cross-section characteristics from year to year.*

- **Longitudinal Profiles:** The Mainstem Reach 1 Longitudinal Profile water surface data needs to be evaluated and corrected. Trendlines should not be used on water surface plots for any of these profiles, please correct with a simple line connecting the points.
    - *The water surface data was re-evaluated as requested. Note, the beaver dam located within the restoration reach, in tandem with the rain event occurring during the survey of this profile, was resulting in a backwater effect upstream of the dam. Trendlines have been removed from the longitudinal profiles.*

- **Cross-Sections:** The large adjustments to the bankfull elevation in the UT3 cross-sections provide an incomparable reference for assessing aggradation within the reach. Please provide detailed explanation predicting future channel response at these aggraded sections and describe any proposed measures such as possible grade control structures to maintain this aggraded material and insure a more predictable outcome. Update the geomorphic tables to reflect the decreased cross-sectional areas following the aggradation.
    - *The aggradation observed in UT3 is the direct result of the cattle damage that occurred in MY2. Based on the vegetated channel banks and bottom in MY3, which has been lacking in MY1 and MY2 and allowed for transportation of the finer sediments downstream, it is anticipated that the channel response now and in the*

future will provide greater durability and stability in the channel profile and bank slopes. UT3 will be monitored during the winter and spring seasons for possible degradation of this aggregated material that has led to a better functionality of this tributary. Should erosion be identified, grade control through wood sills may be implemented during Year 4; however, no new grade control structures are proposed at this time. Currently, some head control exists in the UT3 profile through bedrock encountered during construction. The cross-section data presented in Table 11a is based on the base-line bankfull elevation and already accounts for the loss in cross-sectional area due to this aggradation event.

- **Cross-Sections:** Top of Rebar is shown in the cross-section legends but some of the cross-section data lines do not extend to the cross-section monuments (rebar). Please provide all cross-section data in the graphs to confirm that annual cross sections are aligned properly. If no additional data is available, please explain why the cross sections do not have the same start and end point associated with the rebar monuments.
    - *Rebar points for cross section lengths are shown as the top of rebar, as surveyed in the baseline and each monitoring year. Some of the rebar are at angles to the ground due to placement or debris hitting them during storm events. This is true for UT2-1R and UT7-1P, for example. Top of rebar stationing for MS3P, UT3-1R, UT3-3R, UT4-1P, and UT4-1R were referenced to the incorrect stationing in the MY3 cross-section plot update. This has been corrected. All data collected in MY3 went from rebar to rebar on both sides of the channel, or beyond depending on slope breaks.*

If you have any further questions or comments please contact me at rmaycock@louisberger.com or 919-866-4428.

Sincerely,

Robin L. Maycock

Robin Maycock
Project Manager

CC: Ed Samanns, Louis Berger
Matt Holthaus, Louis Berger
Douglas Parker, Louis Berger

Table of Contents

Appendices

Appendix A. Project Vicinity Map & Background Tables
Figure 1 – Project Vicinity Map
Figure A1 – Project Components Map
Table 1 – Project Mitigation Components
Table 2 – Project Activity and Reporting History
Table 3 – Project Contacts Table
Table 4 – Project Baseline Information and Attributes

Appendix B. Visual Assessment Data
Figure 2a-2j – Integrated Current Condition Plan View-MY3
Table 5a-g – Visual Stream Morphology Stability Assessment Table
Table 6a-e – Vegetation Condition Assessment Table
Photo Appendices A-E: Vegetation Monitoring Photographs, Cross Section Photographs, Photo Station Photographs, Problem Area Photographs, Significant Flow Events

Appendix C. Vegetation Plot Data
Table 7 – Vegetation Plot Criteria Attainment
Table 8 – Total Planted Stems
Table 9 – CVS Vegetation Plot Metadata and Planted and Total Stem Counts (Species by Plot with Annual Means)

Appendix D. Stream Measurement & Geomorphology Data
Table 10aa-af – Baseline Stream Data Summary
Table 10ba-bg – Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Table 11aa-ag – Monitoring Data: Dimensional Morphology Summary (Dimensional Parameters – Cross Section)
Table 11ba-bf – Monitoring Data: Stream Reach Data Summary
Figure 3a-d – Longitudinal Profile Plots
Figure 4a-o – Cross-section Plots
Figure 5a-o – Pebble Count Plots

Appendix E. Hydrologic Data
Table 12 – Documentation of Geomorphologically Significant Flow Events
Figure 6a-e – Water Level and Rainfall Plots
Table 13 – Continuous Flow Record

1.0 Executive Summary

1.1 Project Setting and Background

The Little Buffalo Creek Stream Mitigation site is located in Cabarrus County, North Carolina, two miles southwest of the Town of Gold Hill, and 12 miles east of Kannapolis. The site encompasses approximately 47 acres of former cattle pasture, crop land and riparian forest along Little Buffalo Creek and portions of seven unnamed tributaries (Figures 1 and 2). Little Buffalo Creek is located within the Yadkin River Basin (03040105; 03040105020060). Historic land use at the site had consisted primarily of ranching activities that had allowed cattle access to the stream and riparian zone. Several reaches of the stream have bedrock in their streambed and vertical migration of the stream has been confined to a small percentage of the project site.

1.2 Project Goals and Objectives

The goals of the Little Buffalo Creek Stream Restoration project include, but are not limited to, the enhancement of water quality and aquatic/terrestrial habitat, stream stability improvement, and erosion reduction. The uplift of these stream functions specifically requires:

- Protecting and improving water quality through the removal or minimization of the biological, chemical, and physical stressors:
  - Reducing sediment input into the stream from erosion;
  - Reducing non-point pollutant impacts by removing livestock access (including restoring forested buffer);
  - Protecting headwater springs.
- Improving aquatic and terrestrial wildlife habitat:
  - Moderating stream water temperatures by improving canopy coverage over the channel;
  - Restoring, enhancing, reconnecting, and protecting valuable wildlife habitat.
- Restore floodplain connectivity:
  - Reestablishing floodplain connection thereby dissipating energy associated with flood flows.

In addition to the ecological uplift that the project will provide to the Site through the improvement of the stream functions, this project establishes the following environmentally advantageous goals:

- Providing a water source for livestock removed from the stream and riparian corridor;
- Reducing the number of locations that livestock are able to cross the stream;
- Providing a safe and environmentally appropriate stream crossing point for livestock.

In order to achieve the project goals, Berger proposes to accomplish the following objectives:

- Fence the cattle out of the stream and riparian corridor;
- Remove invasive vegetative species from the riparian corridor;
- Restore and enhance unstable portions of the stream;
- Preserve the stream channel and banks through a conservation easement;
- Plant the riparian corridor with native tree and shrub vegetation.

The expected ecological benefits and goals associated with the Little Buffalo Creek site mitigation plan serve to meet objectives consistent with the resource protection objectives detailed in the Yadkin-Pee Dee River Basinwide Water Quality Plan, 2008.

1.3 Project Success Criteria

Streams
For stream hydrology, a minimum of two bankfull events must be documented within the standard 5-year monitoring period. In order for the monitoring to be considered complete, the two verification events must occur in separate monitoring years. All of the morphologic and channel stability parameters will be evaluated in the context of hydrologic events to which the system is exposed.

- Dimension – General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. For stream dimension, cross-sectional overlays and key parameters such as cross-sectional area, and the channel's width to depth ratios should demonstrate relative stability in order to be deemed successful.
- Pattern – Pattern features should show little adjustment over the standard 5 year monitoring period. Rates of lateral migration need to be moderate.
- Profile – For the channels' profile, the reach under assessment should not demonstrate any trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes.
- Substrate and Sediment Transport – Substrate measurements should indicate progression towards, or maintenance of the known distributions from the design phase. Sediment Transport should be deemed successful by the absence of any significant trend in the aggradation or depositional potential of the channel.

Vegetation
Survival of woody species planted at mitigation sites should be at least 320 stems/acre through Year 3. A 10 percent mortality rate will be accepted in year four (288 stems/acre) and another 10 percent in Year 5 resulting in a required survival rate of 260 trees/acre through Year 5. This is consistent with Wilmington District (1993) guidance for wetland mitigation (USACE 2003).

1.4 Mitigation Components and Design
The Little Buffalo Creek Site consists of six reaches along the main stem and seven unnamed tributaries (UTs). The main stem of Little Buffalo Creek as well as UT 4 and UT 7 are perennial streams. The remainders of the UTs are intermittent streams associated with groundwater seeps. This stream mitigation project includes reaches of restoration, enhancement, and preservation along the main stem and the associated UTs. In total, the Site will provide 13,362 linear feet of restoration, enhancement, and preservation (Tables 1 & 4). A summary of restoration and enhancement activity and reporting history can be found in Table 2.

Restoration activities have established a new, stable stream channel with the appropriate dimension, pattern and profile to transport perennial flow and sediment and have re-connected the stream to its floodplain. Reestablishment of native riparian forest vegetation and installation of cattle exclusion fencing were also performed as part of the restoration activities. Enhancement activities included reestablishing native riparian vegetation within a 50-foot easement along each bank of the stream corridor and excluding cattle with fencing. In the case of enhancement level I the activities included reshaping or relocating the bed and banks

and riparian forest planting. Preservation was conducted within portions of the stream corridors that have intact riparian forests and stable stream reaches and included excluding cattle with fencing. At a 1:1 ratio for restoration, 1.5:1 for enhancement level I, 2.5:1 for enhancement level II, and a 5:1 ratio for preservation, the DMS will receive, as of December 2017, approximately 6,411 stream mitigation units from the Site (Table 1). In addition, approximately 47 acres of riparian buffer have been protected within a conservation easement. This stream credit generation has the potential to increase to 6,450 stream mitigation units as a result of additional enhancement level I work conducted in the fall of 2016 within a portion of UT3. This area, previously assessed as enhancement level II, had additional entrenched portions of the tributary graded to re-connect the channel with its floodplain and the riparian zone replanted.

1.5 Monitoring Year 3 Conditions Assessment

1.5.1 Vegetation Assessment

1.5.1.1 Planted Stems

When examining planted stems only, in Year 3 of monitoring, seven vegetation monitoring plots (1, 4, 5, 7, 8, 9, and 12) are exceeding requirements by 10% (387 to 629 stems/acre), one vegetation monitoring plot (2) is exceeding requirements by less than 10% (339 stems/acre), no vegetation monitoring plots fail to meet requirements by less than 10% (290 stems/acre), and four vegetation monitoring plots (3, 6, 10, and 11) are failing to meet requirements by over 10% (194 to 242 stems/acre). The current average estimate of 387 planted stems per acre for the site is exceeding the required success criteria of 320 stems per acre. Uplift in previously poor performing areas is due to the additional planting of approximately 2,860 trees within 10 riparian areas that took place in March 2017.

1.5.1.2 Combined Planted/Volunteer Stems

When examining combined planted/volunteer stems, in Year 3 of monitoring, ten vegetation monitoring plots (1, 2, 4, 5, 6, 7, 8, 9, 11, and 12) are exceeding requirements by 10% (532 to 2,275 stems/acre), no vegetation monitoring plots are exceeding requirements by less than 10% (352 stems/acre), one vegetation monitoring plot (3) fails to meet requirements by less than 10% (290 stems/acre), and one vegetation monitoring plot (10) is failing to meet requirements by over 10% (194 stems/acre). Recruitment of native plant seedlings was recorded in 11 of 12 vegetation monitoring plots (Tables 6, 7, 8, and 9). The current average estimate of 875 combined planted/volunteer stems per acre for the site is exceeding the planted stem success criteria of 320 stems per acre.

1.5.1.3 Plots 3, 6, 10, &11 Performance

Any performance deficiencies are primarily associated with the areas around four monitoring plots (3, 6, 10, and 11) failing to meet requirements for planted stem counts. The causes for the poor performance in these areas, as well as lower than expected survival in some replanted areas, is likely site specific.

Vegetation monitoring plot 3, though underperforming, has remained stable. One potential reason for vegetation plot 3's underperformance is that it is a drier location that is isolated from the mature seed trees necessary for recruitment of volunteers. This theory is re-enforced by only slight differences between planted and combined planted/volunteer stem counts (242 versus 290 stems per acre). In addition, the planted trees in vegetation plot 3 exhibited signs of deer foraging. A potential solution is a different selection of species, which can tolerate drier conditions, for replanting.

Vegetation monitoring plot 6 has seen fluctuations. A potential reason for vegetation plot 6's underperformance in planted stems (242 stems/acre) is competition from grasses (specifically allopathic fescue). However, vegetation plot 6's combined planted/volunteer stem counts (1016) exceeds requirements

by over 10%. This is due primarily to the recruitment of fast growing sycamores ranging in height from approximately 2 to 9 feet, which are more successful in competing with the grass. A potential solution for these areas is to plant larger trees that can successfully compete with the grass.

Vegetation plot 10 has seen steady improvement. A potential reason for vegetation plot 10's underperformance in both planted stems (194 stems/acre) and combined planted/volunteer stems (194 stems/acre) is competition from groundcovers. The heavy groundcover shades out new plantings and volunteer seedlings. A potential solution for these areas is to plant larger trees that can successfully compete with the ground cover.

Vegetation plot 11 has shown steady decline for planted stems (338/Year 0 to 242/Year 3 stems/acre) and combined planted/volunteer stems (8,470/Year 0 to 1,016/Year 3 stems/acre) which may be due to underlying soil issues or rock formations. Notes from construction of this area indicate shallow depth to bedrock. Soil samples will be collected and submitted to the State soil lab for textural and soil fertility analysis. Potential solutions would be examined when soil sample results are obtained. Tree establishment and survival will continue to be monitored. Additional soil treatment and planting will be performed in the fall of 2018.

The fall is the time most suitable for tree establishment in the region, with larger plant material and of different species suitable for site specific conditions within each location discussed above.

1.5.1.4 Volunteer Species/Volunteer Diversity

Species diversity has steadily increased from Year 0 (10 planted) to current Year 3 (22 combined planted/volunteer). The increase in two species was due to direct plantings of slippery elm (*Ulmus rubra*) and blackgum (*Nyssa sylvatica*) in March 2017.

The remaining increase of ten species would be volunteers. In Year 1, three new volunteer species were noted: red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and eastern red cedar (*Juniperus virginiana*). In Year 2, two new volunteer species were noted: boxelder (*Acer negundo*) and common elderberry (*Sambucus canadensis*). In the current Year 3, five new volunteer species were noted: eastern baccharis (*Baccharis halimifolia*), common persimmon (*Diospyros virginiana*), loblolly pine (*Pinus taeda*), smooth sumac (*Rhus glabra*), and sassafras (*Sassafras albidum*).

Overall, twenty-five species have been noted. The specific reason for the three species discrepancy is unknown but is believed to be either due to the volunteer's failure to thrive or species identification updates (as seedlings are difficult to identify). The three species difference were: Virginia pine (*Pinus virginiana*), pitch pine (Pinus rigida), and black walnut (*Juglans nigra*).

When comparing planted stems only between Year 2 and Year 3, seven vegetation monitoring plots (2, 4, 7, 8, 9, 10, and 12) have seen an increase in species diversity, three vegetation plots (1, 3, and 11), have maintained species diversity, and two vegetation plots (5 and 6) lost species diversity. The increase would be due to the March 2017 plantings. When comparing combined planted/volunteer stems between Year 2 and Year 3, nine vegetation monitoring plots (1, 2, 4, 7, 8, 9, 10, 11, and 12) saw an increase in species diversity, one vegetation monitoring plot (3) maintained species diversity, and two vegetation monitoring plots (5 and 6) lost species diversity. Vegetation plot 5 is fluctuating for unknown reasons. Vegetation plot 6 is having competition issues from grasses.

1.5.1.5 Non-plot Assessment

The NOAA Historical Palmer Drought Indices for 2016-2017 indicate that the area experienced a moderate drought. Irrespective, significant growth was observed in planted American sycamore (*Platanus*

occidentalis) and black willow (*Salix nigra*) trees, probably because the conditions in 2016 allowed for their establishment. Other planted species were observed to be healthy but not exhibiting significant growth. Tree establishment and survival will continue to be monitored.

Black willow and silky dogwood (*Cornus amomum*) live stakes throughout the restoration areas are doing well and very few have been observed to be dead. Surviving stakes are continuing to grow quickly and contribute to bank stability. Soft rush (*Juncus effusus*) has become established on parts of the stream bank and is adding additional stability to sections of UT7 and UT3. Additional stability is being provided by grasses and sedges that have become established on banks throughout the site. Volunteer crop cover is no longer present and has been outcompeted by other species such as goldenrods (*Solidago*), asters (*Aster*), dogfennel (*Eupatorium capillifolium*), and native grasses.

Previously there were areas within the riparian buffer that were having low success in establishing herbaceous vegetation cover due to drought and sections of bank scour. These areas included approximately 300 feet along the main stem of Reach 1, approximately 130 feet along the main stem of Reach 4, and approximately 530 feet of UT 3. These problem areas were reseeded with annual ryegrass and native forbs in February 2016. Reseeded areas total approximately 1.8 acres and make up 53% of E1 areas and 20% of restoration areas. Based on observations during an initial site visit in the early spring of 2017, no additional seeding was performed in these specific areas in 2017.

Reach 1 has improved greatly through the previous reseedings; however, there is a small bare patch, approximately 0.02 acres, with no herbaceous cover on the left bank flood plain. The herbaceous cover in the 130 foot section along the main stem of reach 4 has improved since reseeding, but a small area of poor herbaceous coverage, approximately 0.01 acres, has be identified at the bottom portion of E1 work. The herbaceous cover in the 530 foot section of UT3 has significantly improved from year 2 to year 3 of monitoring; however, a section approximately 130 feet long on the left bank is still in poor herbaceous coverage. Overall herbaceous cover throughout the site has greatly increased. Additional native grass and forb seeding will be performed in the spring of 2018 to address these isolated areas with poor herbaceous cover.

1.5.1.6 Evasive Species

Past treatment and removal of privet (*Ligustrum*), multiflora rose (*Rosa multiflora*), and tree-of-heaven (*Ailanthus altissima*) from riparian areas has been mostly successful, though a few problem areas remain and follow up treatment will be performed. Through site inspections, tree-of-heaven is still established at the upstream ends of both UT 2 (approx. 450ft) and UT 7 (approx. 400ft), as well as four large trees between UT4 and UT3 (Figure 2). The larger trees at UT7 have been treated with herbicide and at time of monitoring were either dead or dying. However, they still produced seeds or root sprouts and will require further control. The UT 2 area was treated but will require further treatment as well. A mature tree was noted along the west bank of Reach 1. Approximately six saplings below that tree were removed by hand. Tree-of-heaven saplings were noted on the north side of Old Mine Road. In addition, mature tree-of-heaven trees were noted just outside of the easement on the east side of Reach 1. Princess tree (*Paulownia tomentosa*) was noted in Reaches 3 and 4 and in Plot 6. Privet continues to be present in various areas throughout the site, particularly in Reach 1 and Reach 4. Princess tree, privet and tree-of-heaven will be treated with herbicide application again in spring of 2018 in accordance with NC Department of Agriculture (NCDA) rules and regulations.

1.5.2 Stream Assessment

Overall, the site has shown significant recovery since Year 2 monitoring. Where cattle had damaged portions of UT 3, natural recovery through storm events have reshaped the thalweg to that of the designed B6 channel type. Additionally, much of the problematic herbaceous coverage and resulting bank scouring has been eliminated as vegetation has recovered and stabilized the banks. No remedial action is anticipated to be

needed through the portions of Reaches 2 through 5, or UT 2, UT 3, and UT 4 due to the cattle damage as the channels have shown significant improvement, and are identified as stable.

The following lists the key/potential problems identified through the project during Year 3 monitoring, from the upstream limits of the project site to the downstream limits, followed by a discussion with recommended remediation actions/no action to be taken for each problem:

- Beaver dams within Reach 1;
- No defined channel for 30 feet portion of UT2 (wetlands);
- 48 feet of undercutting banks, 4-15 inches deep, along the interior left bank in Reach 3;
- Scoured banks along the portion of E1 in Reach 4;
- Lateral point bars within UT 7 forming sinuous low flow channel;
- Piping of rock vane in step pool feature of UT 7.

In November 2017, DMS representatives conducted their yearly site visit to evaluate the project reaches. Louis Berger, following the DMS site visit, held a coordination call with DMS in early December 2017 to discuss these issues and possible solutions. The recommended actions discussed herein are based conversations with DMS representatives and the best possible action to be taken at this stage of monitoring.

Multiple beaver dams were identified within Reach 1 by DMS during their site visit. During the September 2017 site visit for Year 3 monitoring, beaver dams were not observed within Reach 1. A follow up field effort was performed by Louis Berger in early November 2017 to collect additional thalweg information in Reach 1. Louis Berger identified a single beaver dam within the portions of restoration in Reach 1 that is creating a backwater effect. Louis Berger is coordinating with the landowner to trap and remove beaver from the project site. Once the beaver have been removed, any dams found within the project site will be breached and banks shaped by hand to limit the amount of temporary damage to the channel while also restoring flow to the channel segments.

As identified in Year 1 and Year 2 as a potential problem, approximately 30 feet of channel segment in the lower portions of UT 2 have filled with finer sediments and vegetated to the point that no defined channel exists for this 30 foot length. DMS has recommended conducting a site visit with the North Carolina IRT to discuss possible credit alternatives for this 30 feet of E2, such as partial credit for the riparian floodplain since wetland credits are not included in this contract.[1] Based on the field conditions, performing remedial action to excavate a shallow channel within this short segment will likely refill with sediment. Upstream sediment supplies at the top of UT 2 consist of very fine soils that will most likely continue to deposit within this area and refill any constructed channel. Louis Berger will modify its recommendations for this feature following the meeting with the IRT and DMS in the spring of 2018.

Following the lowering of the upper riffle within the restoration portion of Reach 3 during September 2016, an undercut of the left bank has formed for approximately 48 feet of the bank, that ranges from 4 inches to 15 inches deep into the bank. With the lowering of the riffle, controlling the profile of this reach, combined with the finer gravel/coarse sand that has not maintained a significant compaction for the bank along a meander bend and curve pool in the channel pattern, velocities within the low flow channel during storm events have been eating into the lower portions of the bank to cause the undercut. Louis Berger recommends no immediate action at this point in time. The vegetation has taken significant root with willows within this portion of the channel, stabilizing upper portions of the inner bank with roots. It is believed that the undercut will begin to resolve itself, resulting in a small shift of the low flow channel that is reinforced by the willow

[1] This measurement is based on visual observations and needs to be measured for exact linear feet of stream. DMS has noted that their observations are more than 30 feet of linear stream length with no defined channel. This will be measured in field for the exact stream length the IRT meeting for proper discussion on the credit generation possibilities.

roots, forming a better bend in the curve pool. Multiple visits are expected between remedial work and meeting with the IRT at the beginning of the year that will allow for continued observation in the immediate future. Should this issue progress to a point of more significant instability that is not indicative of resolving itself, remedial action to remove the undercut by hand will be conducting during the dry season in 2018.

Small portions of bank scour were observed in September 2017 along the segment of E1 in Reach 4. The scour consisted of a 15 foot section approximately 1.5 feet high, and a 6 foot section approximately 6 inches high. These segments are likely the result of a lack of inner vegetative coverage taking hold this past growing season and settlement along the banks of smaller gravel sizes in the reach. No action is recommended at this time as vegetative support is likely to increase over the next growing season and provide added bank stabilization. There are no signs of instability in the reach or banks adjacent to these small segments.

A sinuous low flow channel within the areas of restoration at UT 7 continue to develop, as expected, and has formed lateral point bars in which willows are taking root. The development of this sinuous channel at base flow conditions is important to providing adequate riffle-pool systems needed at base flow to provide in-stream habitat areas for fish, amphibians, and aquatic insects. These point bars are consistent with the formation of interior benches observed in the reference reach and on the main stem and do not pose a risk to the stability of the channel. Therefore, no action is recommended at this time.

In-stream structures have generally maintained their stability and performance within the site, with the exception of the step-pool system on UT 7 near the confluence with the main stem. The infilling of the step-pool system was noted during the year 1 and 2 monitoring (September 2015 and 2016), and no action was recommended as the segment is stable and vegetation establishment is very successful in this area. In addition, one rock vane step pool was identified in September 2016 as having potential piping in one location. As the channel was dry, it could not be verified that the structure was allowing seepage beneath the vane. During the spring 2017 maintenance work, it was not observed to be piping and flow was observed to go over the rock vane as intended, thus no action was taken this past year. However, during the DMS site visit in November 2017 piping was observed along this rock vane. As discussed with DMS, the section of channel is stable under the current conditions; therefore, no corrective action is recommended at this time. The structure will be monitored through Year 4 and 5. Should significant changes occur that indicate an instability has formed, corrective action will be taken.

Despite 2017 being a non-drought year, the months of June, July and September were again below average rainfall months and stretches of UT7 were dry during the September monitoring and portions of the main stem did not have significant depths for flow at the time of monitoring. Water surface shots were not taken where water was stagnant within the channel.

As occurred in Year 2 of monitoring, pebble count surveys were not conducted in the following cross sections during the 2017 monitoring event: UT3-1R, UT3-1P, UT3-2R, and UT3-3R. This was due to the channel be consistently lined with vegetation and silt/clay. This is expected to remain consistent for this intermittent stream as it does not have a large sediment supply of larger material.

Future channel maintenance at this time includes removal of the beaver dams and reshaping of the localized areas by hand. Supplemental installations of live stakes and other target vegetation along the channel bank may be incorporated in small, isolated pockets of poor vegetation cover as well.

The stream restoration and enhancement areas are relatively stable and will continue to adjust somewhat in response to storm events. Gauge data throughout the site supports four different bankfull events during the Year 3 monitoring period which are supported by observations of rack debris outside of the top of bank and in the floodplain of UT7. The stream channel is continuing to develop the desired sinuosity and in-stream

structures are remaining stable and functioning as designed; the minor exception being the step-pool system in UT-7 as noted above.

As commented by DMS in Year 2, and again mentioned in discussions following their site visit in November 2017, UT 2, UT 3, and UT 5 are currently at risk due a lack data to confirm continuous flow for 30 consecutive days within the intermittent streams in the past monitoring years.. All gauges, including those in UT 2 and UT 3, indicated a period of continuous flow for 30 days or more during Year 3 of monitoring, as observed in the water level plots of Figure 6a-6e, and summarized in Table 13. A log of previous years and future years is being maintained to present to the IRT. Louis Berger will deploy an additional water gauge at UT 5 in the winter of 2018 to monitor for continuous flow.

1.5.3 Site Boundary Assessment

Site encroachment management has significantly increased since Year 2 following the site meetings with the landowners in the spring of 2017. As requested by DMS in Year 2 monitoring, communication with landowners following the continued encroachment of cattle within the conservation easement was conducted. During Year 3 monitoring, however, the electric wire of the cattle crossing fence in Reach 5 was not maintained by the landowner and was not providing an electrical charge at the time of the site visit. Additionally, and as noted by DMS, the PVC piping of the flow gates at the cattle crossing are slack, resting on the channel bed. This has resulted in cattle still escaping into the conservation easement, though likely only on rare occasion as it seems evident that the landowners are maintaining the gate closures to the cattle crossing when not in use. DMS noted during their site visit a small calf loose along Reach 6 and UT 7. Fresh manure was also observed in Reach 5 indicating cows have accessed the conservation easement. Additionally, a gate in the corner of the easement fencing at the crossing was placed, but is evident that it is being used to herd cows back into the grazing field and out of the easement when they get loose.

Discussions with the landowner regarding maintenance of the crossing, fencing and encroachments into the easement are continuing, and include the farm managers who are leasing the land. The landowners will again be notified that they are ultimately responsible for the usage of the gate and insuring that the restrictions of the conservation easement are met.

In addition, Larry Hammill has developed an upland pond at the downstream portions of the project site outside of the conservation easement. This occurred after the September 2017 field visit. Larry discussed the water source for this pond coming from the channels within the conservation easement with DMS during their November 2017 site visit. Louis Berger will notify Mr. Hammill that no stream within the conservation easement may be used to source the water for this pond, and all culverts attached to the conservation easement must be removed, additionally, that he may source the water for downstream sections of the channel outside of the conservation easement.

A minor fence repair will be performed in 2018 to address a fallen tree on the easement fence near UT-7. The portion of fence the tree fell on is still functional, but upper portions of barbed wire were broken. The tree has been removed off of the fence, and the barbed wire repair will occur during the next field visit in the winter. Additionally, as requested/recommended by DMS, additional conservation easement boundary markers will be installed at the beginning of 2018 along the lower portions of the conservations easement to reinforce the boundary of the conservations easement.

Summary information/data related to occurrence of items such as encroachment by landowners or evidence of cattle intrusion and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the As-Built Baseline Monitoring Report and in the Mitigation Plan documents available on NCDEQ's website. All raw data supporting the tables and figures in the appendices is available to NCDEQ upon request.

2.0 Methodology

Monitoring for stream stability, stream hydrology, and vegetation will be monitored annually for five years following the initial Baseline and As-Built Report. Annual monitoring requirements are based on the U.S. Army Corps of Engineers *Stream Mitigation Guidelines* document (USACE 2003) and supplemental requirements listed in the DMS *Stream and Wetland Mitigation Monitoring Guidelines* dated February 2014 (NCEEP 2014). Establishment, collection, and summarization of data collected was in accordance with the NCDEQ guidance document *EEP Annual Monitoring Report Format, Data Requirements, and Content Guidance* (April 2015).

2.1 Geomorphology

Surveys for Year 3 monitoring were conducted by Louis Berger in September 2017 using a Trimble M3 Total Station, geo referenced to North Carolina State Plane (NAD83-State Plane Feet-FIPS3200) with vertical datum North American Vertical Datum of 1988 (Feet NAVD88).

2.2 Longitudinal Profiles

A total of approximately 2950 feet of channel along 8 longitudinal profiles is being surveyed annually. This includes 335 feet on LBC Reach 1; 225 feet on LBC Reach 3; 112 feet on LBC Reach 4; 51 feet on UT 2; 771 feet on UT 3; 411 feet on UT 4; 977 on UT 7; and 62 feet on UT 8. Data collected from annual monitoring is being compared with the as-built conditions to document the current state of the channel and any trends in the stream profile occurring throughout the monitoring period. The start and finish locations of each cross-section and longitudinal profile are collected using a Total Station.

2.3 Cross Sections & Particle Size Distribution

A total of 15 cross-sections, including 9 riffles and 6 pools were installed upon completion of construction and are being monitored annually. Two additional cross-sections were added within the step-pool portion of UT 7 in monitoring Year 2. The total number of cross-sections includes five on the main stem of Little Buffalo Creek, one on UT 2, four on UT 3, two on UT 4, and five on UT 7.

Pebble count surveys were conducted at each cross section. Moving from bank to bank, particles were picked up blindly and at random and measured in millimeters. Enough samples were taken to get a representative sample of particle size distribution for each cross section. Sample size ranged from 50 in pool areas dominated by fines to 100 in flowing riffle areas with a diversity of particle sizes.

2.4 Vegetation Monitoring

The Carolina Vegetation Survey (CVS)-DMS entry tool database was used to calculate the number of monitoring plots needed based on project acreage. Louis Berger established twelve vegetation monitoring plots across all reaches and tributaries of the project area based on guidance given in the *CVS-DMS Protocol for Recording Vegetation Version 4.2* (Lee et al. 2008). Each plot measures approximately 0.025 acres individually and is staked out with bright orange painted rebar and marked with two upright sections of PVC pipe. Photos were taken of each plot and Year 3 monitoring data was entered into the CVS-DMS database under the Little Buffalo Creek Stream Mitigation Project (Project ID 94147). Additional PVC markers were added to plot corners during Year 2 in order to make corner stakes easier to find among the increasing herbaceous cover.

For a monitoring event, yellow rope is tied around the four corner stakes to mark out the plot. In Year 0, a GPS was used to collect coordinates of each stem and their position was measured in relation to the X and Y axis of the plot. Additionally, each stem was marked with pink flagging to make them easy to locate and

identify during the next monitoring event. Flagging is re-applied each year. Planted stems were identified, measured, and given a vigor score ranging from 0 to 4 based on the CVS-DMS database. Naturally recruited stems were identified and tallied only if alive. These stems were not measured or given a vigor score.

2.5 Hydrological Monitoring

A total of eight water level gauges were installed on site. The gauges are being monitored biannually to document the highest stage for the monitoring interval and verify occurrences of bankfull and geomorphically significant flow events. In addition, observations of wrack and depositional features in the floodplain, if present, are being documented with photos. In February of 2016 two groundwater monitoring wells were installed at the top and bottom of UT 3 to provide additional hydrological data to demonstrate groundwater connectivity to the stream channel.

In addition to the event stage monitoring, the gauges are being utilized to monitor base flow for verification of water flow for a continuous 30-day period. Gauges are secured in place through PVC structures in channel pools (Reach 1, Reach 4, UT 4 and UT 7), or in the channel bed (UT 2, UT 3, and soon UT 5). Elevations are tied to the gauge structures, in which the thalweg invert elevation immediately downstream of the gauge is also monitored. Base flow is recorded when the elevation of water recorded by the gauge rises above the downstream thalweg control elevation.

2.6 Photo Points & Visual Assessment

Permanent photo stations were established at each cross-section to digitally document annual conditions of the left and right banks. Each vegetation monitoring plot includes a photo station taken diagonally from a plot corner towards the opposite plot corner. Additional permanent photo locations have been established throughout the project area and can be found on the Current Conditions Plan View (CCPV) maps in Appendix A. Visual stream assessments are conducted during annual monitoring to summarize performance percentages of morphological and structural features. Visual vegetation assessments are also occurring to catalog the extent and type of vegetation issue areas as compared to the total planted acreage within the project site.

3.0 References

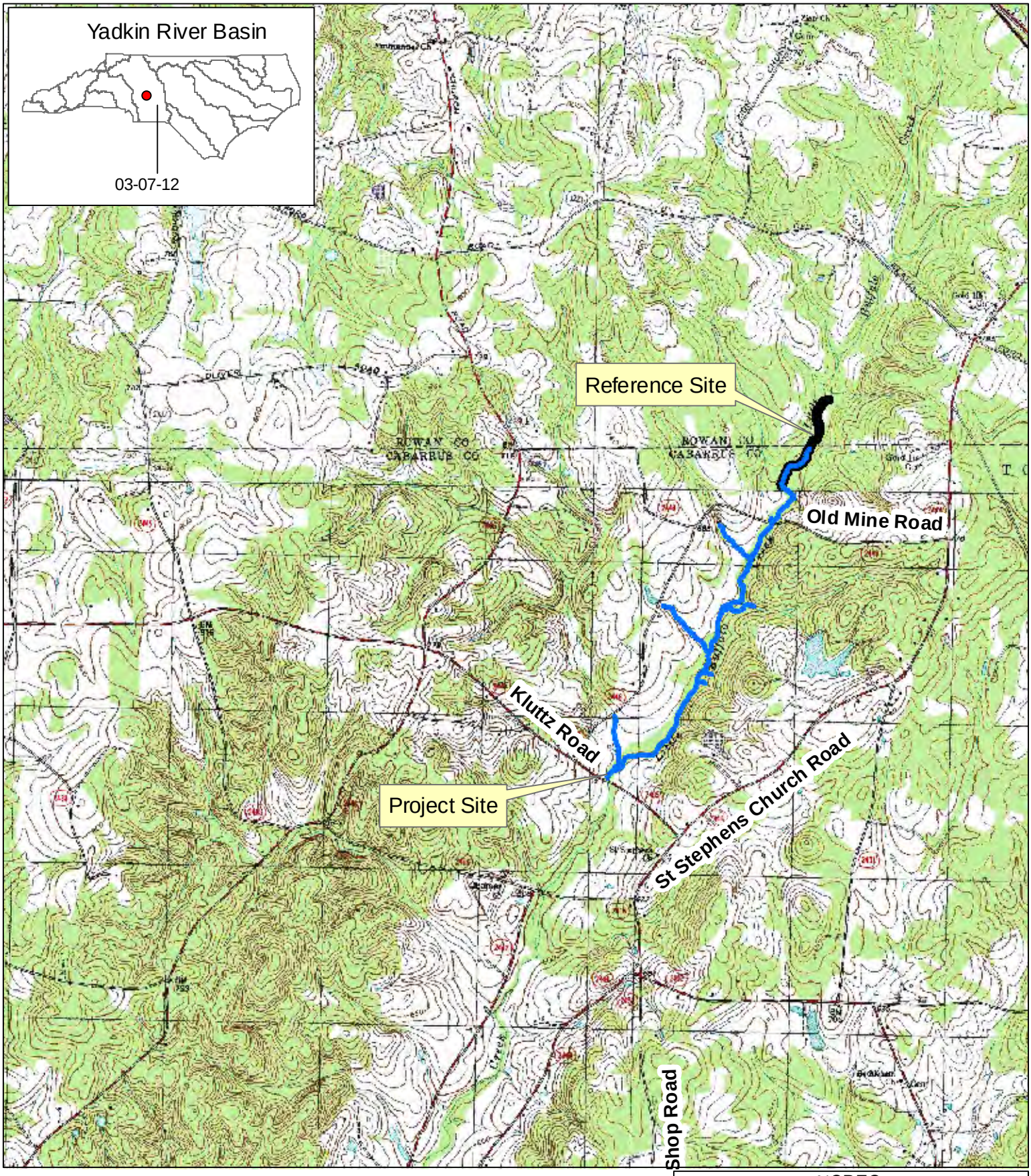
Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-DMS Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm).

National Oceanic and Atmospheric Administration. Historical Palmer Drought Indices. December 2014 through November 2015. http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/201412-201511/. Accessed October 2016.

North Carolina Ecosystem Enhancement Program 2014. *Stream and Wetland Mitigation Monitoring Guidelines*. February 2014. 7pp.

USACE 2003. Stream Mitigation Guidelines. Prepared by: USACE, NCDWQ, USEPA, NCWRC.

Appendix A – Project Vicinity Map & Background Tables



Legend

- Project Stream Segments
- Reference Reach

N

0 0.5 1 Miles

Source: USGS Topographic Quads: Gold Hill, Rockwell, Richfield, and Mount Pleasant, NC

NCDEQ
Division of Mitigation Services

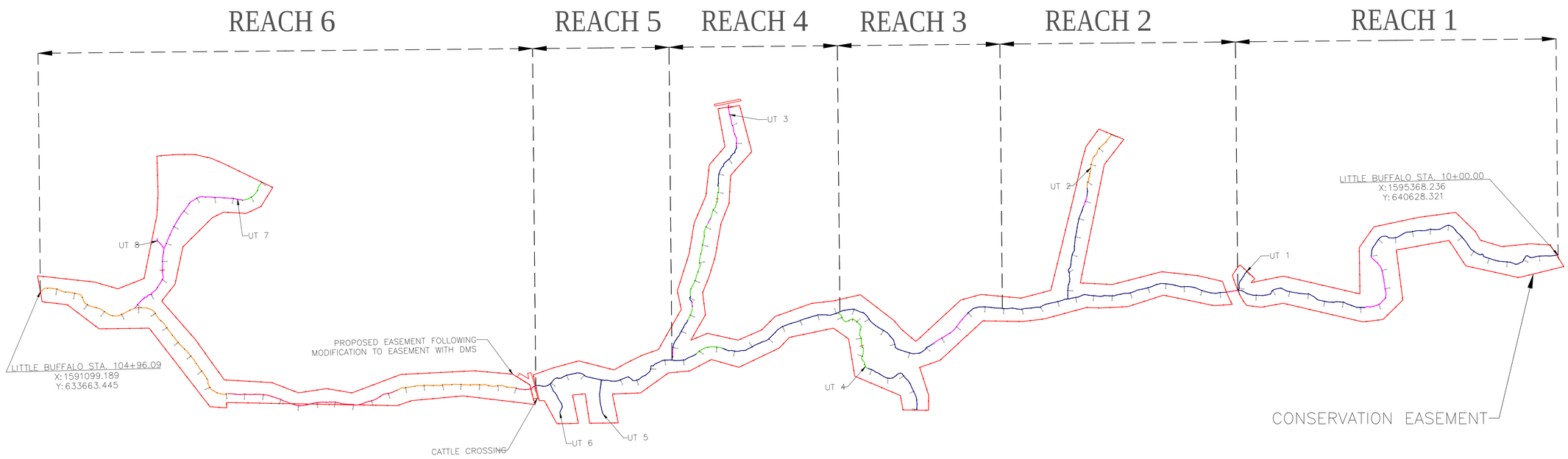
Little Buffalo Creek Creek
Stream Restoration, Cabarrus County, NC
DMS Project # 94147

Project Location Map

THE LOUIS BERGER GROUP
1001 Wade Avenue, Suite 400
Raleigh, NC 27605

Figure 1

November 2016



MAINSTEM RESTORATION PLAN INDEX

ALIGNMENT	MITIGATION ACTIVITY	START STATION	END STATION
MAINSTEM	ENHANCEMENT LEVEL 2	10+00	22+00.00
	RESTORATION	22+00.00	25+77.37
	ENHANCEMENT LEVEL 2	25+77.37	33+04.88
	ENHANCEMENT LEVEL 2	33+66.34	48+12.45
	RESTORATION	48+12.45	50+56.51
	ENHANCEMENT LEVEL 2	50+56.51	63+70.48
	ENHANCEMENT LEVEL 1	63+70.48	65+21.37
	ENHANCEMENT LEVEL 2	65+21.37	74+87.83
	PRESERVATION	76+04.73*	82+55.35
	PRESERVATION	91+88.65	104+96.09

*:CONSERVATION EASEMENT MODIFICATION TO BE COMPLETED IN MY4 FOR CHANGE IN CATTLE CROSSING DESIGN.

MITIGATION ACTIVITY	GENERAL DESCRIPTION
RESTORATION	CHANNEL RE-ALIGNMENT AND CREATION. DITCH PLUG INSTALLATION. IN-STREAM STRUCTURE INSTALLATION, INCLUDING LOG VANES, ROCK CROSS VANES, STEP POOLS AND ROOT WADS. STREAM BANK RE-GRADING. PLANTING AND INVASIVE PLANT REMOVAL.
ENHANCEMENT LEVEL I (E1)	STREAM BANK GRADING. MINOR CHANNEL REGRADING. CONCRETE REMOVAL FROM CHANNEL. PLANTING AND INVASIVE PLANT REMOVAL.
ENHANCEMENT LEVEL 2 (E2)	PLANTING AND INVASIVE PLANT REMOVAL.
PRESERVATION	INVASIVE PLANT REMOVAL.
NO CREDIT	NO WORK.

TRIBUTARY RESTORATION PLAN INDEX

ALIGNMENT	MITIGATION ACTIVITY	START STATION	END STATION
UT-1	ENHANCEMENT LEVEL 2	10+00	11+10.63
UT-2	PRESERVATION	10+00	13+34.67
UT-2	ENHANCEMENT LEVEL 2	13+34.67	13+78.56
UT-2	RESTORATION	13+78.56	14+27.35
UT-2	ENHANCEMENT LEVEL 2	14+27.35	19+50.70
UT-3	RESTORATION	10+00	12+15.05
UT-3	ENHANCEMENT LEVEL 2	12+15.05	14+66.62
UT-3	ENHANCEMENT LEVEL 1	14+66.62	16+60
UT-3	RESTORATION	16+60	16+79
UT-3	ENHANCEMENT LEVEL 1	16+79	20+90.79
UT-3	ENHANCEMENT LEVEL 2	20+90.79	21+29
UT-3	RESTORATION	21+29	21+55
UT-3	ENHANCEMENT LEVEL 1	21+55	22+32.49
UT-3	ENHANCEMENT LEVEL 2	22+32.49	24+05
UT-3	RESTORATION	24+05	24+50
UT-3	ENHANCEMENT LEVEL 2	24+50	24+74.90
UT-4	ENHANCEMENT LEVEL 2	10+00	14+21.25
UT-4	ENHANCEMENT LEVEL 1	14+21.25	18+30.57
UT-5	ENHANCEMENT LEVEL 2	10+00	11+84.46
UT-6	ENHANCEMENT LEVEL 2	10+00	11+51.33
UT-7	ENHANCEMENT LEVEL 1	10+00	11+46.80
UT-7	RESTORATION	11+46.80	21+26.71
UT-8	RESTORATION	10+19.08	10+80.78

NO. | REVISIONS | DRN. CHK | DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

PROJECT COMPONENTS MAP

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE A1 OF 10

Filename: W:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\Monitoring Reports_Restoration Stationing Figure\Restoration Summary Figure.dwg

Table 1. Project Components and Mitigation Credits
Little Buffalo Creek Stream Mitigation Project
DMS Project No. 94147

Mitigation Credit Summations

	Stream	Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset			
Overall Mitigation Units	6,411	0	0						

Project Components

Reach ID	Stationing	Existing Feet (linear feet)	Restoration Footage or Acreage	Restoration Level	Restoration or Rest Equiv.	Mitigation Ratio	Stream Mitigation Units	Notes
Reach 1	10+00 to 33+05	2,305	377 R 1928 EII	Restoration Enhancement Level II	N/A	Restoration 1:1 Enhancement Level II 2.5:1	1148	
Reach 2	33+66 to 46+10	1,244	1244 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	498	
Reach 3	46+10 to 56+93	1,083	244 R 839 EII	Restoration Enhancement Level II	N/A	Restoration 1:1 Enhancement Level II 2.5:1	580	
Reach 4	56+93 to 66+62	969	151 EI 818 EII	Enhancement Level I Enhancement Level II	N/A	Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	428	
Reach 5	66+62 to 74+88	826	826 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	330	
Reach 6	75+19 to 82+55; 91+89 to 104+96	2,043	2,043 P	Preservation	N/A	Preservation 5:1	409	
UT 1	10+00 to 11+11	111	111 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	44	
UT 2	10+00 to 19+51	951	49 R 567 EII 335 P	Restoration Enhancement Level II Preservation	N/A	Restoration 1:1 Enhancement Level II 2.5:1 Preservation 5:1	343	
UT 3	10+00 to 24+75	1,475	305 R; 536 EI 634 EII	Restoration Enhancement Level I Enhancement Level II	N/A	Restoration 1:1 Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	916	Potential to increase mitigation units after conversion of an EII area to EI
UT 4	100+00 to 18+31	831	410 EI 421 EII	Enhancement Level I Enhancement Level II	N/A	Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	442	
UT 5	10+00 to 11+84	184	184 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	74	
UT 6	10+00 to 11+51	151	151 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	60	
UT 7	10+00 to 21+27	1,127	980 R 147 EI	Restoration Enhancement Level I	N/A	Restoration 1:1 Enhancement Level I 1.5:1	1078	
UT 8	10+19 to 10+81	62	62 R	Restoration	N/A	Restoration 1:1	62	

Note: Due to rounding some of the values when added may appear to be 1' short of total, this is purely a product of values being rounded to nearest linear foot

Length and Area Summations

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration	2,017	N/A	N/A	N/A	201,700	N/A
Enhancement	N/A	N/A	N/A	N/A	N/A	N/A
Enhancement I	1,244	N/A	N/A	N/A	124,400	N/A
Enhancement II	7,723	N/A	N/A	N/A	772,300	N/A
Creation	N/A	N/A	N/A	N/A	N/A	N/A
Preservation	2,378	N/A	N/A	N/A	237,800	N/A
High Quality Preservation	N/A	N/A	N/A	N/A	N/A	N/A

BMP Elements

Element	Location	Purpose/Function	Notes

Table 2: Project Activity and Reporting History		
Little Buffalo Creek Stream Mitigation Project		
DMS Project No. 94147		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Technical Proposal	June 2009	August 2008
Categorical Exclusion	February 2010	March 2010
Secure Conservation Easement	March 2010	July 2012
Mitigation Plan	August 2010	April 2014
Final Design – Construction Plans	N/A	May 2014
Construction	June 2014	December 2014
Fencing Installation	June 2014	December 2014
Native Species Planting	December 2014	December 2014
Mitigation Plan / As-built (Year 0 Monitoring – Baseline)	March 2015	June 2015
Year 1 Monitoring	September 2015	December 2015
Replanting & Reseeding	N/A	February 2016
Year 2 Monitoring	September 2016	January 2017
Replanting & Reseeding	N/A	March 2017
Invasive Treatment	N/A	March 2017
Fence Repairs	N/A	December 2016
Construction Repairs	N/A	September 2016
Year 3 Monitoring	September 2017	December 2017
Replanting & Reseeding	N/A	*October 2018
Invasive Treatment	N/A	*April 2018
Fence Repairs	N/A	*March 2018
Beaver Dam Removal and Repair	N/A	*March 2018
Year 4 Monitoring		
Year 5 Monitoring		

*:Estimated dates for maintenace activities.

Table 3: Project Contact Table Little Buffalo Creek Stream Mitigation Project DMS Project No. 94147	
Designer Primary Project Design POC	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, NC 27605 Edward Samanns (973) 407-1468
Construction Contractor **Construction contractor POC**	Backwater Environmental, Doug Smith P.O. Box 1107 Eden, NC 27289
Fencing Contractor Fencing Contractor POC	Strader Fencing Inc 5434 Amick Road Julian, NC 27283
Planting Contractor Planting Contract POC	Carolina Sylvics 908 Indian Trail Edenton, NC 27932
Nursery Stock Suppliers	Mellow Marsh 1312 Woody Store Rd. Siler City, NC 27344 919-742-1200 ArborGen Inc. 2011 Broadbank Court Ridgeville, SC 29472 843-851-4129 Superior Trees Inc. 12493 US-90 Lee, FL 32059 850-971-5159
Monitoring Performers	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, NC 27605
Stream Monitoring POC	Louis Berger Group, Inc., Robin Maycock (919-866-4428)
Vegetation Monitoring POC	Louis Berger Group, Inc.

Table 4 Project Information			
Project Name	Little Buffalo Creek Stream Mitigation Project		
County	Cabarrus County		
Project Area (acres)	12		
Project Coordinates (latitude and longitude)	35.491041°N, . -80.366698° W.		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Yadkin-Pee Dee River		
USGS Hydrologic Unit 8-digit	3040105	USGS Hydrologic Unit 14-digit	3040105020060
DWQ Sub-basin	03-07-12		
Project Drainage Area (acres)	4,039		
Project Drainage Area Percentage of Impervious Area	5%		
CGIA Land Use Classification	Rural		

Reach Summary Information (Mainstem)

Parameters	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Length of reach (linear feet)	2,305	1,244	1,083	969	826	2,043
Valley classification	Type 8	Type 8	Type 8	Type 8	Type 8	Type 8
Drainage area (acres)	1914	2146	2446	2568	2632	4039
NCDWQ stream identification score	37.5	37.5	37.5	37.5	37.5	37.5
NCDWQ Water Quality Classification	C	C	C	C	C	C
Morphological Description (stream type)	C4/F4	C4/E4	C4/F4	C4	C4/D4b	C4
Design Rosgen Stream Type	C4	C4	C4	C4	C4	C4
Evolutionary Trend						
Design Approach (P1, P2, P3, E, etc)	R; EII	EII	R; EII	EI; EII	EII	P
Underlying mapped soils	Chewacla/ Goldston	Chewacla	Chewacla	Chewacla	Chewacla	Chewacla
Drainage class	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained
Soil Hydric status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope	0.48%	0.38%	0.51%	0.39%	0.47%	0.43%
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A
Native vegetation community	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture
Percent composition of exotic invasive vegetation						

Reach Summary Information (Unnamed Tributaries)

Parameters	UT 1	UT 2	UT 3	UT 4	UT 5	UT 6	UT 7/UT 8
Length of reach (linear feet)	111	951	1,475	831	184	151	1,127
Valley classification	N/A	Type 2	Type 2	Type 2	N/A	N/A	Type 8
Drainage area (acres)	293	193	62	254	8	16	1222
NCDWQ stream identification score	21	20	26.5	36.5	27.5	24.8	36.5
NCDWQ Water Quality Classification	C	C	C	C	C	C	C
Morphological Description (stream type)	N/A	B6	B6/G6	B4c	N/A	N/A	F4
Design Rosgen Stream Type	No Restoration	B6	B6	B4c	No Restoration	No Restoration	C4
Evolutionary Trend							
Design Approach (P1, P2, P3, E, etc)	EII	R; EII, P	R; EI; EII	EI; EII	EII	EII	R; EI
Underlying mapped soils	Chewacla	Chewacla	Badin/Georgeville	Goldston	Goldston	Goldston	Chewacla
Drainage class	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained
Soil Hydric status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope	N/A	2.45%	2.35%	2.17%	N/A	N/A	0.96%
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Native vegetation community	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent composition of exaotic invasive vegetation	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Wetland Summary Information

Parameters	Wetland 1	Wetland 2	Wetland 3
Size of Wetland (acres)	N/A	N/A	N/A
Wetland Type (non-riparian, riparian riverine or riparian	N/A	N/A	N/A
Mapped Soil Series	N/A	N/A	N/A
Drainage class	N/A	N/A	N/A
Soil Hydric Status	N/A	N/A	N/A
Source of Hydrology	N/A	N/A	N/A
Hydrologic Impairment	N/A	N/A	N/A
Native vegetation community	N/A	N/A	N/A
Percent composition of exotic invasive vegetation	N/A	N/A	N/A

Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	Y	Y	Permit 2014-00386
Waters of the United States – Section 401	Y	Y	Letter from NCDENR dated February 24, 2015 Nationwide Permit Number 27
Endangered Species Act	Y	Y	Letter to USFWS dated November 16, 2009
Historic Preservation Act	Y	Y	Letter from NC SHPO dated February 2, 2010
Coastal Zone Management Act (CZMA)/ Coastal Area Management	N	N/A	N/A
FEMA Floodplain Compliance	Y	Y	FEMA Floodplain Checklist Restoration Plan Appendix 9
Essential Fisheries Habitat	N	N/A	N/A

Appendix B – Visual Assessment Data

Figures 2a-j – Integrated Current Condition Plan View-MY3

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

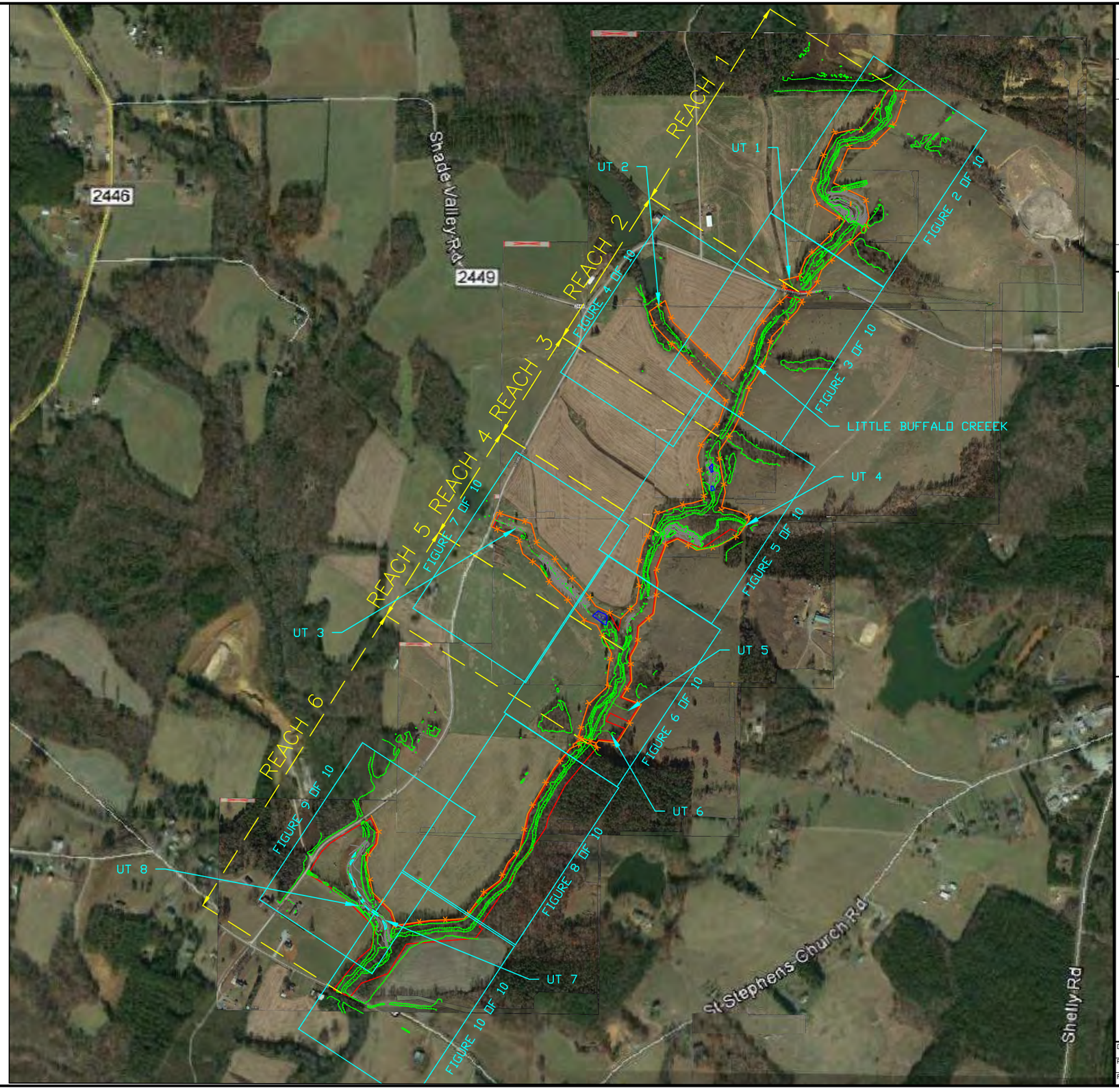
VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 800' 1600'

SCALE: 1"= 800'



NCDEQ-DMS

NO.	REVISIONS	DRN	CHK	DATE

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 1 OF 10

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

BEGIN UPSTREAM
MAINSTEM RESTORATION
STA. 22+00
END E2

BEGIN BEDROCK
EL: 638.68

END BEDROCK
EL: 638.56

GAGE 1

VEGPLOT 12

PL 13

LITTLE BUFFALO STA. 10+00.00
BEGIN E2
X:1595368.236
Y:640628.321

GATE

CROSS SECTION MS-1P

LITTLE BUFFALO CREEK

BEGIN BEDROCK
EL: 638.03

END BEDROCK
EL: 637.97

BEAVER DAM

VEGPLOT 11

PL 12

CROSS SECTION MS-1R

END UPSTREAM
MAINSTEM RESTORATION
STA. 25+77.37
BEGIN E2

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%-40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

0' 100' 200'

SCALE: 1"= 100'

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW -MY3-

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 2 OF 10

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%-40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

UT-2 STA. 13+34.67
END PRESERVATION
BEGIN E2

UT-2 STA. 14+27.35
END RESTORATION
BEGIN E2

CROSS SECTION UT2-1R

VEGPLOT 8

UT 2

UT 1

BEGIN UT-1 STA. 10+00.00
BEGIN E2

UT-1 STA. 11+10.63
LITTLE BUFFALO STA. 32+99
END UT-1 E2

LITTLE BUFFALO CREEK

VEGPLOT 9

GAGE 3

PL 10

PL 11

VEGPLOT 10

OLD MINE RD

16 SOIL

BOULDERS

GATE

UT-2 STA. 19+50.70
LITTLE BUFFALO STA. 42+43
END UT-2 E2

LITTLE BUFFALO STA. 33+66.34
BEGIN E2
BEGIN REACH 2

LITTLE BUFFALO STA. 33+04.88
END E2

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 3 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

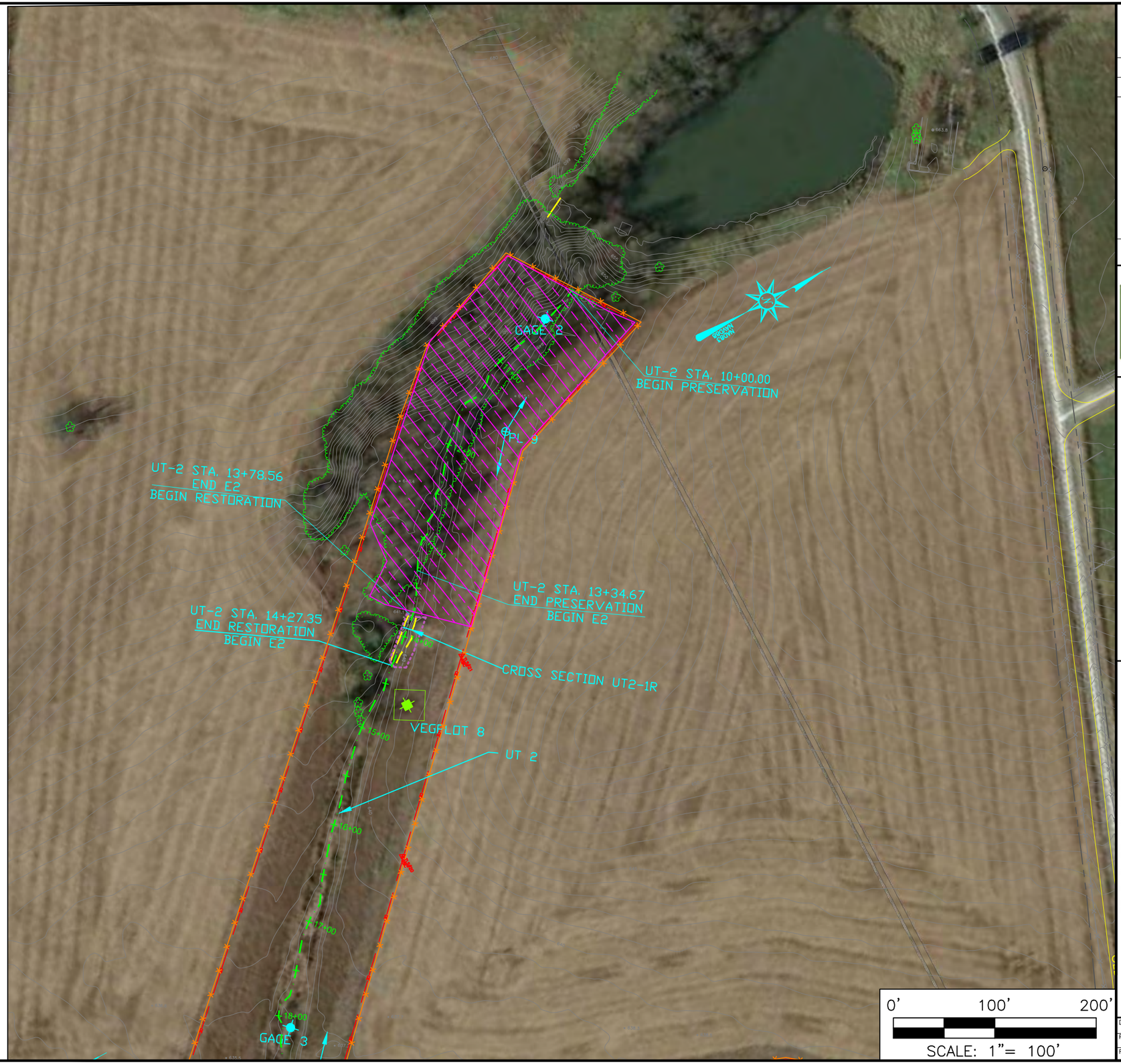
LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14



NO.	REVISIONS	DRN.	CHK.	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 4 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

UT-4 STA. 18+30.57
LITTLE BUFFALO STA. 56+93
END UT-4 E1

CROSS SECTION UT4-1R

BEGIN BEDROCK
EL: 624.94

END BEDROCK
EL: 624.30

VEGPLOT 4

RI 7

GATE

VEGPLOT 5

GAGE 4

CROSS SECTION
UT4-1P

UT 4

UT-4 STA. 14+21.25
END E2
BEGIN E1

LITTLE BUFFALO CREEK

MY2 CHANNEL REPAIR

VEGPLOT 6

MY2 CHANNEL REPAIR

LITTLE BUFFALO STA. 46+10
END REACH 2
BEGIN REACH 3

RI 8

VEGPLOT 7

BEGIN DOWNSTREAM
MAINSTEM RESTORATION
STA. 48+12.45
END E2

CROSS SECTION MS-2R

CROSS SECTION MS-2P

END DOWNSTREAM
MAINSTEM RESTORATION
STA. 50+56.51
BEGIN E2

UT-4 STA. 10+00.00
BEGIN E2

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 100' 200'

SCALE: 1"= 100'

BANK SCOUR/ERODING
AGGRADATION
ENCROACHMENT/COW PRINTS
LATERAL POINT BARS
CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

LEGEND:

- THALWEG
- AS–BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 5 OF 10

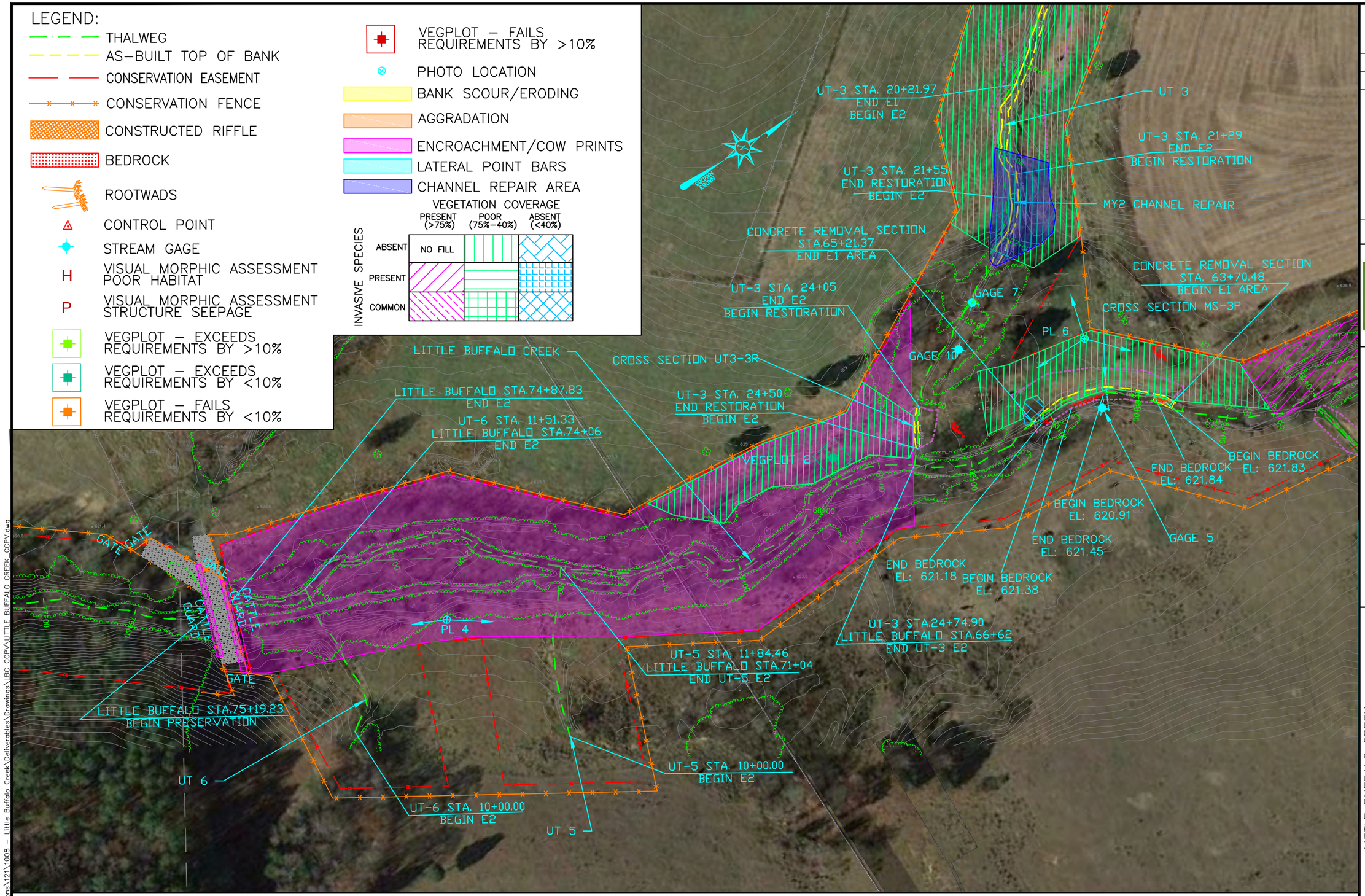
Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			



0' 100' 200'

SCALE: 1"= 100'

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 6 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%-40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW -MY3-

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 7 OF 10

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

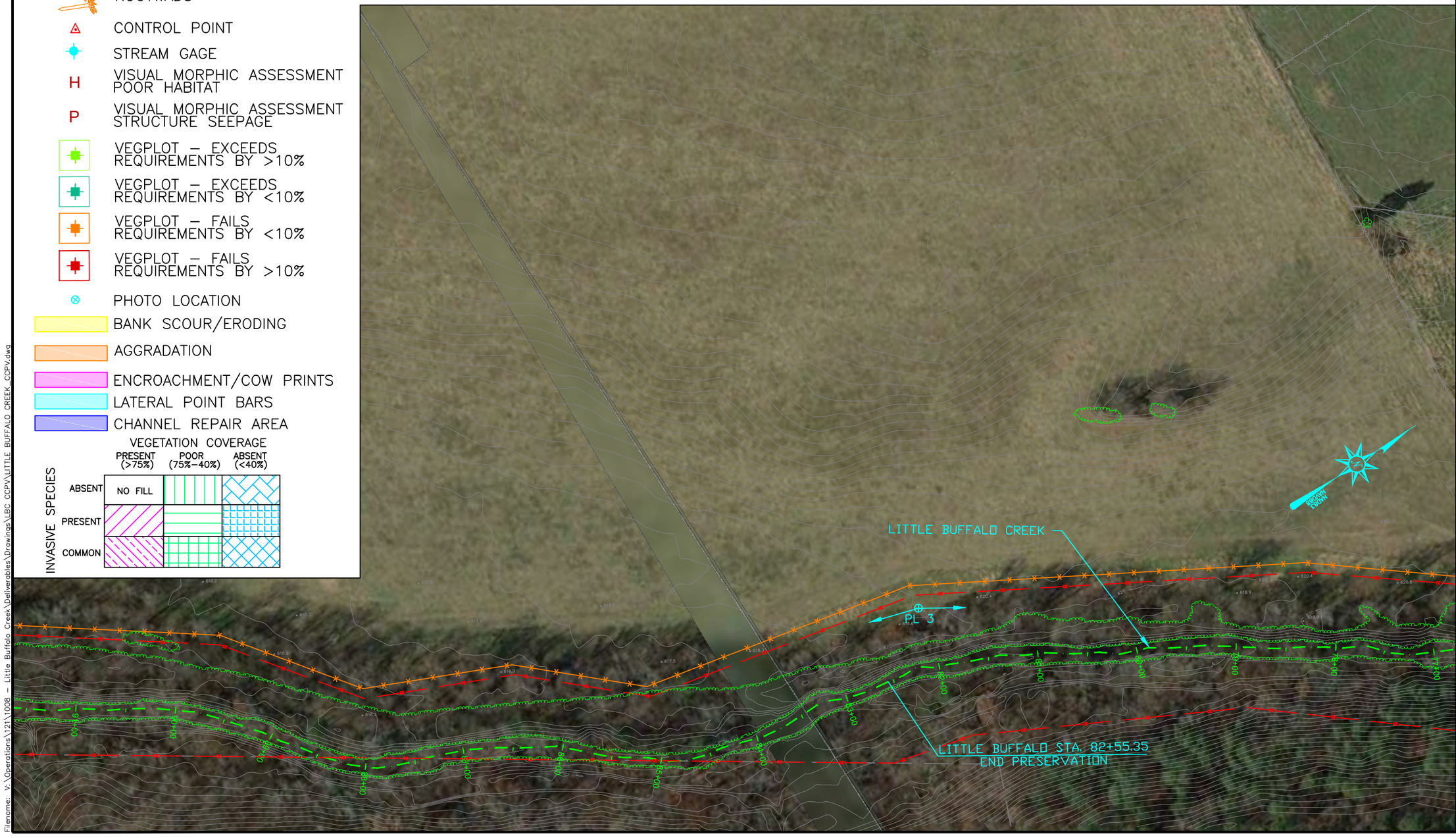
VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14



NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

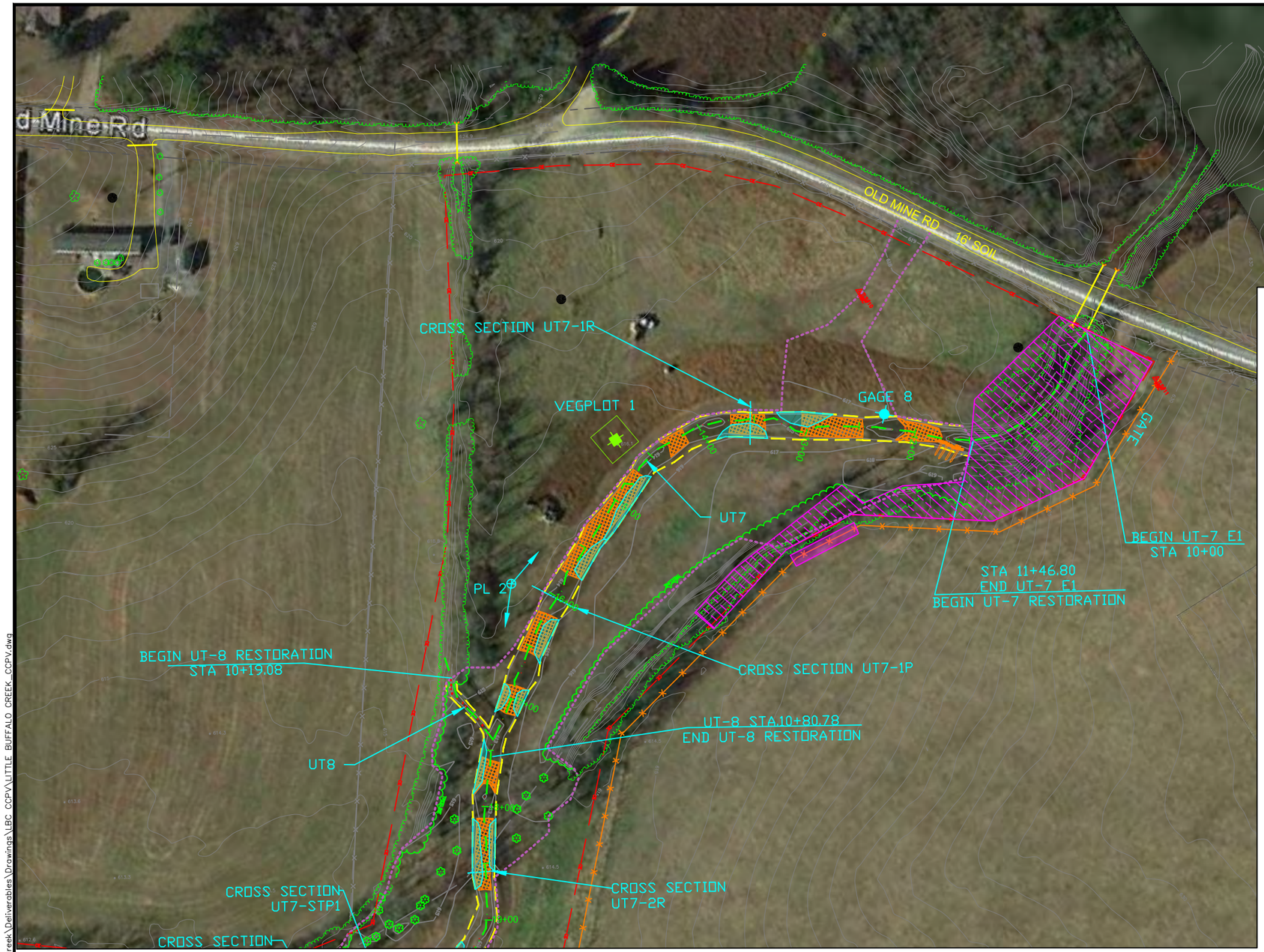
THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 8 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg



AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

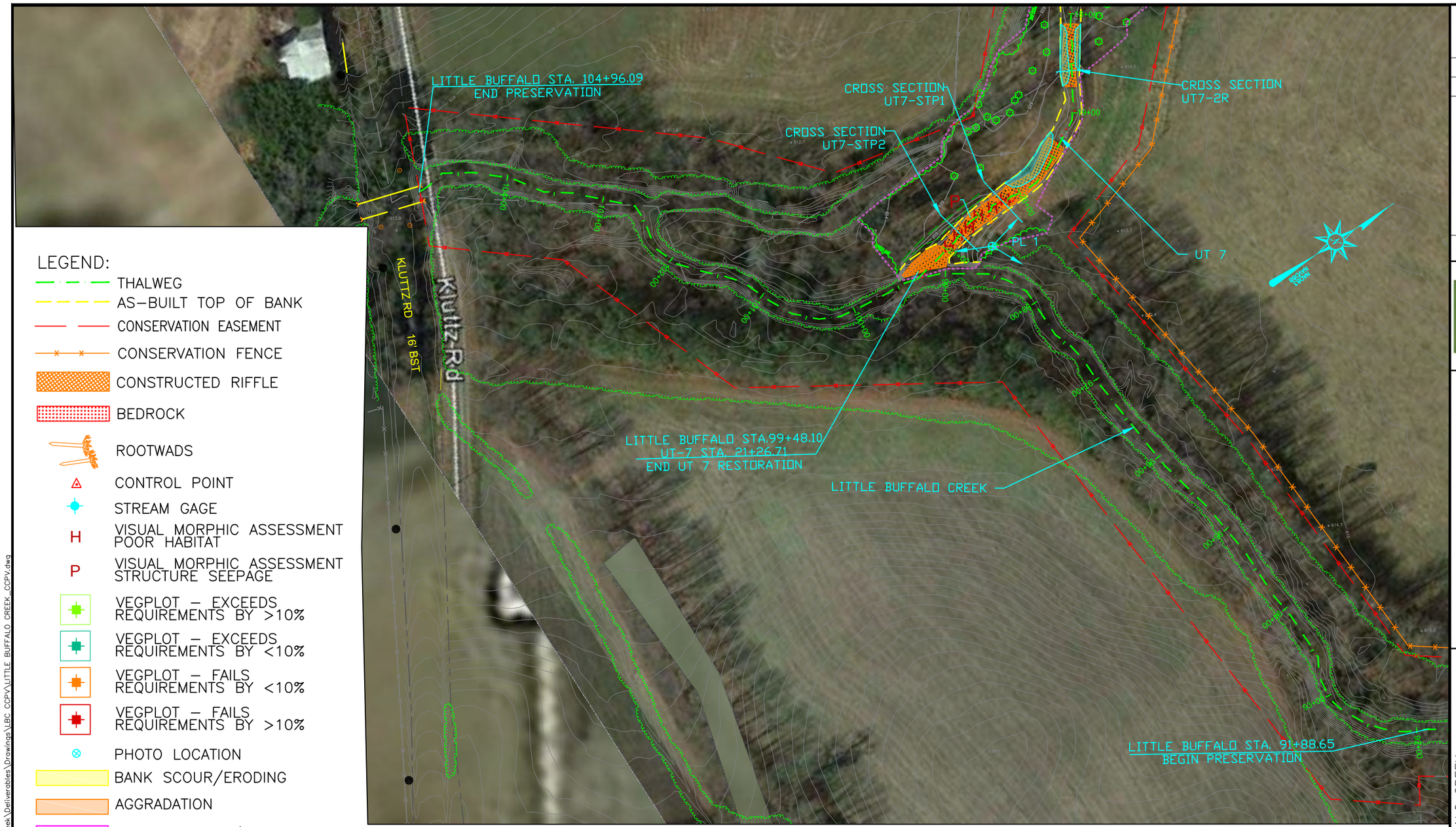
THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 9 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg



LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGRADATION
- ENCROACHMENT/COW PRINTS
- LATERAL POINT BARS
- CHANNEL REPAIR AREA

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 100' 200'

SCALE: 1"= 100'

NO.	REVISIONS	DRN.	CHK.	DATE

NCDEQ-DMS

THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY3–

DATE FEBRUARY 2018
PROJECT NO. 94147
FIGURE 10 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

Tables 5a-g – Visual Stream Morphology Assessment

Reach ID Reach 1
Assessed Length 381

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			1	18	98%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	6	6			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	3			100%			
		2. Length appropriate?	3	3			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	3	3			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	Log Vane structures installed incorrectly during construction, final as-built developed inner berm material overtop structures to bury the log vanes and have no structures within this reach.									

Reach ID Reach 3
Assessed Length 261

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	3	3			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	48	91%	1	20	96%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	48	91%	1	20	96%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	2			100%			
	3. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Reach ID Reach 4
Assessed Length 200

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	3	3			100%			
2. Bank	1. Scoured/Eroding	Visual point scour along small portion of bank within bankfull			1	15	96%	0	0	98%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	15	96%	0	0	98%

Reach ID UT 2

Assessed Length 49

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed[1]	1. Vertical Stability	1. Aggradation - No visual aggradation[1]			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	1	1			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%

1: The assessed length of UT2 for visual morphology has been limited to the portion of Enhancement Level I in the reach. A section of Enhancement Level II along the lower ends of UT2, approximately 30 feet of stream, has been found to aggradate and function more as a wetland due to the sediment supplies upstream. This length is based on visual measurement. An actual measurement will be conducted at the next site visit for discussion with the IRT.

Reach ID UT 3
Assessed Length 898

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation	Note: aggradation as a result of cattle damage occurred during MY 2, however, UT 3 has rebounded, is stable, and great condition geomorphically		0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	8	8			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%

Reach ID UT 4
Assessed Length 410

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	8	8			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	3			100%			
		2. Length appropriate?	3	3			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	3	3			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%

Reach ID UT 7/8
Assessed Length 1189

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - Lateral Point Bars have formed, but as expected due to the overwide channel design. Reach is in stable condition, so point bars were omitted from this section.			0	0	100%			
		2. Degradation - degradation in last curve pool before step pool system - occurred in MY 2, not included on MY3 CCPV			1	40	98%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	11	11			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	4			75%			
		2. Length appropriate?	4	4			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	4	4			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	4	4			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms. -DMS Identified piping in one rock vane in step pool feature	8	9			89%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.- step pools filled with large boulders from upstream of site, maintains small pools at low flow, but <1.6 Max to Mean Deptj	3	9			33%			

Tables 6a-i – Vegetation Condition Assessment Table

Table 6 Vegetation Condition Assessment

Reach 1

Planted Acreage **5.47**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material - area does not meet threshold	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	2	0.71	13.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	2	0.71	13.0%

Easement Acreage **7.29**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Tree of Heaven, Chinese Privet	1000 SF	Pattern and Color	4	0.28	3.9%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

Reach 2

Planted Acreage **2.85**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage **3.73**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern		1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

Reach 3

Planted Acreage **2.65**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	2	0.54	20.6%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	2	0.54	20.6%

Easement Acreage **3.83**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Princess Tree	1000 SF	Pattern and Color	1	0.07	1.7%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

Reach 4

Planted Acreage **2.26**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material - area does not meet threshold	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.39	17.3%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.39	17.3%

Easement Acreage **3.1**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Princess Tree	1000 SF	Pattern and Color	2	0.23	7.4%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

Reach 5

Planted Acreage **2.05**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.34	16.6%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.34	16.6%

Easement Acreage **2.74**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern		1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Electric wire on cattle crossing fence not maintained, isolated cows escaped into easement at Reach 5/Reach 6	none	Pattern and Color	3	2.74	100.0%

UT 2

Planted Acreage **1.25**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage **2.65**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Chinese Privet, tree of heaven	1000 SF	Pattern and Color	1	1.03	38.9%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

UT 3

Planted Acreage **3.21**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material. - area does not meet threshold	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	3.21	100.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	1	3.21	100.0%
			Cumulative Total	2	3.21	100.0%

Note: UT 3 has low stem density below MY 3 criteria, while also showing poor vigor for plantings there. Upland species are surviving, where more wet tolerant are deteriorating due to site conditions being dryer at this location

Easement Acreage **4.11**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern		1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

UT 4

Planted Acreage **1.43**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Top of bank area bare where sheet flow washed seeding into channel	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage **2.01**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Chinese Privet	1000 SF	Pattern and Color	1	0.03	1.5%
5. Easement Encroachment Areas		none	Pattern and Color	0	0.00	0.0%

UT 7

Planted Acreage **2.63**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage **6.07**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Japanese Honeysuckle, Tree of Heaven, Chinese Privet	1000 SF	Pattern and Color	1	0.54	8.9%
5. Easement Encroachment Areas	Fence damaged due to tree falling on it	none	Pattern and Color	1	0.02	0.3%

Photo Appendix A: Vegetation Monitoring Plots

Veg Plot 1

Veg Plot 2

Veg Plot 3

Veg Plot 4

Veg Plot 5

Veg Plot 6

Veg Plot 7

Veg Plot 8

Veg Plot 9

Veg Plot 10

Veg Plot 11

Veg Plot 12

Photo Appendix B: Cross Sections

Cross Section MS-1P Downstream

Cross Section MS-1P Upstream

Cross Section MS-1R Downstream

Cross Section MS-1R Upstream

Cross Section MS-2P Downstream

Cross Section MS-2P Upstream

Cross Section MS-2R Downstream

Cross Section MS-2R Upstream

Cross Section MS-3P Downstream

Cross Section MS-3P Upstream

Cross Section UT2-1R Downstream

Cross Section UT2-1R Upstream

Cross Section UT3-1P Downstream

Cross Section UT3-1P Upstream

Cross Section UT3-1R Downstream

Cross Section UT3-1R Upstream

Cross Section UT3-2R Downstream

Cross Section UT3-2R Upstream

Cross Section UT3-3R Downstream

Cross Section UT3-3R Upstream

Cross Section UT4-1P Downstream

Cross Section UT4-1P Upstream

Cross Section UT4-1R Downstream

Cross Section UT4-1R Upstream

Cross Section UT7-1P Downstream

Cross Section UT7-1P Upstream

Cross Section UT7-1R Downstream

Cross Section UT7-1R Upstream

Cross Section UT7-2R Downstream

Cross Section UT7-2R Upstream

Photo Appendix C: Photo Stations

Photo Location 1-A – Mainstem Upstream

Photo Location 1-B – Mainstem Downstream

Photo Location 1-C – UT7 Upstream

Photo Location 2-A – UT7 Upstream

Photo Location 2-B – UT7 Downstream

Photo Location 3-A - Upstream

Photo Location 3-B - Downstream

Photo Location 4-A – Upstream

Photo Location 4-B - Downstream

Photo Location 5-A - Downstream

Photo Location 5-B – Upstream

Photo Location 6-A – Mainstem Downstream

Photo Location 6-B – Mainstem Upstream

Photo Location 6-C – UT3 Upstream

Photo Location 7-A – Mainstem Downstream

Photo Location 7-B – UT4 Downstream

Photo Location 7-C – Mainstem Upstream

Photo Location 7-D – UT4 Upstream

Photo Location 8-A - Downstream

Photo Location 8-B - Upstream

Photo Location 9-A - Downstream

Photo Location 9-B – Upstream

Photo Location 10-A – Mainstem Downstream

Photo Location 10-B – Mainstem Upstream

Photo Location 10-C – UT2 Upstream

Photo Location 11-A –Downstream

Photo Location 11-B - Upstream

Photo Location 12-A - Downstream

Photo Location 12-B – Upstream

Photo Location 13-A – Downstream

Photo Location 13-B – Upstream

Photo Appendix D: Problem Areas

Bare spots and eroding slopes on outskirts of floodplain in reach 1

Bare spot in floodplain in reach 1

Beaver dam in restoration area of reach 1

Downstream portions of channel below beaver dam in restoration area of reach 1

Panoramic view of beaver dam in restoration area of reach 1

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

Undercut along the left interior channel bank in restoration area of reach 3

15 foot bank scour along the right bank in restoration area of reach 4

15 foot bank scour along the right Bank in restoration area of reach 4

6 foot bank scour along the right bank in restoration area of reach 4

6 foot bank scour along the right bank in restoration area of reach 4

Poor vegetation coverage along right upper bank of restoration area in reach 4

Gates open at cattle crossing along Little Buffalo Creek. Area not being maintained by owners.

Gates open at cattle crossing along Little Buffalo Creek. Area not being maintained by owners.

Cattle crossing opening in flood gate, with no electric power. Not being maintained by owners.

Gate installed by property owners at corner of cattle crossing for getting escaped cows out of easement.

Tree of heaven in upper portions of UT2

Tree of heaven in upper portions of UT2

Poor vegetation along portion of left bank in UT3

Fresh cow pies between UT3 and UT4. Likely getting in by cattle crossing.

Tree fallen on easement fence at UT7. Minor damage will need repair.

Photo Appendix E: Significant Flow Events

Debris dropped and vegetation bent in direction of flow at UT7, March 2017.

Appendix C – Vegetation Plot Data

Table 7 – Vegetation Plot Criteria Attainment

Plot	MY3 Success Criteria Met (Y/N)	Tract Mean
1	Y	67%
2	Y	
3	N	
4	Y	
5	Y	
6	N	
7	Y	
8	Y	
9	Y	
10	N	
11	N	
12	Y	

Table 8 - CVS Vegetation Plot Metadata

Report Prepared By	Gregory A. Russo
Date Prepared	12/8/2017 10:08
database name	cvs-eep-entrytool-v2.3.1.mdb
database location	C:\Users\grrusso\Desktop
computer name	MTN-GRUSSO7
file size	62197760

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	94147
project Name	Little Buffalo Creek Stream Mitigation Project
	Louis Berger is restoring the Little Buffalo Creek Stream Mitigation Site in Cabarrus County, North Carolina for the North Carolina Ecosystem Enhancement Program.
Description	Berger will be planting the riparian corridor with native tree and shrub vegetation.
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	48265.23781
Required Plots (calculated)	12
Sampled Plots	12

Table 9 - Planted and Total Stem Counts

EEP Project Code 94147. Project Name: Little Buffalo Creek Stream Mitigation Project

Current Plot Data (MY3 2017)

Scientific Name	Common Name	Species Type	94147-01-0001 PnoLS	P-all	T	94147-01-0002 PnoLS	P-all	T	94147-01-0003 PnoLS	P-all	T	94147-01-0004 PnoLS	P-all	T	94147-01-0005 PnoLS	P-all	T	94147-01-0006 PnoLS	P-all	T
Acer negundo	boxelder	Tree																		
Acer rubrum	red maple	Tree																		2
Alnus serrulata	hazel alder	Shrub																		
Baccharis halimifolia	eastern baccharis	Shrub																		
Carpinus caroliniana	American hornbeam	Tree																		
Celtis laevigata	sugarberry	Tree	1	1	1	2	2	2	2	2	2							1	1	1
Cercis canadensis	eastern redbud	Tree	1	1	1	1	1	1							1	1	1			
Diospyros virginiana	common persimmon	Tree																		
Fraxinus pennsylvanica	green ash	Tree				1	1	1						1	3	3	3	3	3	3
Juglans nigra	black walnut	Tree																		
Juniperus virginiana	eastern redcedar	Tree						3												
Liquidambar styraciflua	sweetgum	Tree			4												28			2
Liriodendron tulipifera	tuliptree	Tree										3	3	3	1	1	2			
Nyssa sylvatica	blackgum	Tree				1	1	1	1	1	1	1	1	1						
Pinus rigida	pitch pine	Tree																		
Pinus taeda	loblolly pine	Tree																		
Pinus virginiana	Virginia pine	Tree																		
Platanus occidentalis	American sycamore	Tree													3	3	11	1	1	11
Quercus falcata	southern red oak	Tree	1	1	1							2	2	2						
Quercus michauxii	swamp chestnut oak	Tree	5	5	5	2	2	2	1	1	1	4	4	4	1	1	1			
Rhus glabra	smooth sumac	Shrub			2															
Sambucus	elderberry	Shrub																		
Sambucus canadensis	Common Elderberry	Shrub															1			
Sassafras albidum	sassafras	Tree																		
Ulmus rubra	slippery elm	Tree						1			1			10						2
Viburnum dentatum	southern arrowwood	Shrub	1	1	1				1	1	1	3	3	3						
		Stem count	9	9	15	7	7	11	5	5	6	13	13	24	9	9	47	5	5	21
		size (ares)	0.83613			0.83613			0.83613			0.83613			0.83613			0.83613		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	7	5	5	7	4	4	5	5	5	7	5	5	7	3	3	6
		Stems per ACRE	435.6	435.6	726	338.8	338.8	532.4	242	242	290.4	629.2	629.2	1162	435.6	435.6	2275	242	242	1016

Scientific Name	94147-01-0007 PnoLS	P-all	T	94147-01-0008 PnoLS	P-all	T	94147-01-0009 PnoLS	P-all	T	94147-01-0010 PnoLS	P-all	T	94147-01-0011 PnoLS	P-all	T	94147-01-0012 PnoLS	P-all	T
Acer negundo			5															
Acer rubrum																		3
Alnus serrulata													2	2	2			
Baccharis halimifolia									1									
Carpinus caroliniana																1	1	1
Celtis laevigata	2	2	2				5	5	5	1	1	1						
Cercis canadensis				3	3	3	1	1	1									
Diospyros virginiana			1															
Fraxinus pennsylvanica	1	1	1															
Juglans nigra																		
Juniperus virginiana																		1
Liquidambar styraciflua						6									2			5
Liriodendron tulipifera							1	1	1	1	1	1						
Nyssa sylvatica	4	4	4	2	2	2	1	1	1				1	1	1	1	1	1
Pinus rigida																		
Pinus taeda															12			
Pinus virginiana																		
Platanus occidentalis							2	2	2	2	2	2	1	1	1	1	1	1
Quercus falcata	1	1	1	2	2	2	1	1	1							1	1	1
Quercus michauxii	2	2	2	5	5	5	1	1	1				1	1	1	4	4	4
Rhus glabra																		1
Sambucus																		
Sambucus canadensis			2															
Sassafras albidum																		1
Ulmus rubra															2			
Viburnum dentatum																		
Stem count	10	10	18	12	12	18	12	12	13	4	4	4	5	5	21	8	8	19
size (ares)	0.83613			0.83613			0.83613			0.83613			0.83613			0.83613		
size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
Species count	5	5	8	4	4	5	7	7	8	3	3	3	4	4	7	5	5	10
Stems per ACRE	484	484	871.2	580.8	580.8	871.2	580.8	580.8	629.2	193.6	193.6	193.6	242	242	1016	387.2	387.2	919.6

Annual Means

Scientific Name	MY3 (2017) PnoLS	P-all	T	MY2 (2016) PnoLS	P-all	T	MY1 (2015) PnoLS	P-all	T	MY0 (2014) PnoLS	P-all	T
Acer negundo			5			2						
Acer rubrum			5			3			4			
Alnus serrulata	2	2	2	5	5	5	5	5	5	13	13	13
Baccharis halimifolia			1									
Carpinus caroliniana	1	1	1	8	8	8	14	14	14	11	11	11
Celtis laevigata	14	14	14	13	13	13	4	4	4	29	29	29
Cercis canadensis	7	7	7	7	7	7	4	4	4	13	13	13
Diospyros virginiana			1									
Fraxinus pennsylvanica	8	8	9	14	14	14	7	7	7	14	14	14
Juglans nigra						6						
Juniperus virginiana			4			3			1			
Liquidambar styraciflua			47			108			254			
Liriodendron tulipifera	6	6	7	5	5	7	10	10	13	19	19	19
Nyssa sylvatica	12	12	12									
Pinus rigida						3						
Pinus taeda			12									
Pinus virginiana									1			
Platanus occidentalis	10	10	28	12	12	27	10	10	52	16	16	16
Quercus falcata	8	8	8	20	20	24	4	4	6	7	7	7
Quercus michauxii	26	26	26	8	8	8	6	6	6	10	10	10
Rhus glabra			3									
Sambucus						8						
Sambucus canadensis			3									
Sassafras albidum			1									
Ulmus rubra			16			1						
Viburnum dentatum	5	5	5	6	6	6	6	6	6	11	11	11
Stem count	99	99	217	98	98	253	70	70	377	143	143	143
size (ares)	10.03356			10.03356			10.03356			10.03356		
size (ACRES)	0.25			0.25			0.25			0.25		
Species count	11	11	22	10	10	18	10	10	14	10	10	10
Stems per ACRE	399.3	399.3	875.2	395.3	395.3	1020	282.3	282.3	1521	576.8	576.8	576.8

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Appendix D – Stream Measurement & Geomorphology Data

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					45.55	56.61	52.02	82.98	14.98	5	43.1	52.2	50.6	64.4	8.8	4	36	36	36	35.21	35.21	35.21	35.21		1
Floodprone Width (ft)					67.73	106.5	96.36	177.3	43.15	5	54.9	75.3	74.3	98	15.4	4	>88	>88	>88	>80	>80	>80	>80		1
Bankfull Mean Depth (ft)					0.65	1.18	1.24	1.6	0.35	5	0.98	1.16	1.1	1.38	0.18	4	0.96	0.96	0.96	1.23	1.23	1.23	1.23		1
[1]Bankfull Max Depth (ft)					2.54	3.04	2.8	3.83	0.58	5	2.17	2.41	2.5	2.5	0.14	4	1.5	1.5	1.5	1.79	1.79	1.79	1.79		1
Bankfull Cross Sectional Area (ft^2)					53.58	63.29	59.12	83.09	11.52	5	55.4	59.3	58.7	64.5	3.36	4	34.38	34.38	34.38	43.15	43.15	43.15	43.15		1
Width/Depth Ratio					32.51	56.56	40.56	127.7	40.14	5	31.3	47	46.2	64.4	14.35	4	37.5	37.5	37.5	28.73	28.73	28.73	28.73		1
Entrenchment Ratio					1.49	1.84	1.92	2.17	0.33	5	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio					**0.91**	**1.09**		**1.37**								**4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		**1**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	35	40	50	7.73	23.71	22.04	38.44		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.003	0.014	0.028	0	0.026	0.022	0.076		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	20	20	4.21	25.43	17.55	83.2		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	1.5	1.81	1.81	1.96	2.71	2.48	3.76		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	80	125	170	29.95	48.64	39.06	91.87		
Pattern																									
Channel Beltwidth (ft)																	84	84	84	59.64	105.8	92.68	165.2		
Radius of Curvature (ft)																	57.62	79.3	101	72.97	83.15	79.01	97.49		
Rc:Bankfull width (ft/ft)																	**35.24**	**36**	**69.62**	**27.95**	**35.6**	**36.13**	**46.36**		
Meander Wavelength (ft)																									
Meander Width Ratio																	1.21	2.33	2.38	1.29	3.04	2.57	5.91		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.334											0.32				0.322			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							C4						C4					C4				C4			
Bankfull Velocity (fps)							1.82											4.36				3.48			
Bankfull Discharge (cfs)							115																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					2293.33				2299.79			
Sinuosity (ft)							1.05						1.25					1.05				1.05			
Water Surface Slope (Channel) (ft/ft)													0.38												
BF slope (ft/ft)													**0.38**												
[3]Bankfull Floodplain Area (acres)																		**0.45**				**0.3959**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data. 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					34.42	41.48	41.54	48.48	7.03	3	43.1	52.2	50.6	64.4	8.8	4	40	40	40	38.31	38.31	38.31	38.31		1
Floodprone Width (ft)					258.2	265.4	265.4	272.6	7.21	3	54.9	75.3	74.3	98	15.4	4	>88	>88	>88	>90	>90	>90	>90		1
Bankfull Mean Depth (ft)					1.2	1.47	1.42	1.8	0.3	3	0.98	1.16	1.1	1.38	0.18	4	1.58	1.58	1.58	1.26	1.26	1.26	1.26		1
[1]Bankfull Max Depth (ft)					2.47	2.78	2.79	3.09	0.31	3	2.17	2.41	2.5	2.5	0.14	4	2	2	2	1.9	1.9	1.9	1.9		1
Bankfull Cross Sectional Area (ft^2)					58.33	59.79	58.96	62.09	2.01	3	55.4	59.3	58.7	64.5	3.36	4	63	63	63	48.23	48.23	48.23	48.23		1
Width/Depth Ratio					19.12	29.59	29.25	40.4	10.64	3	31.3	47	46.2	64.4	14.35	4	39.87	39.87	39.87	30.43	30.43	30.43	30.43		1
Entrenchment Ratio					5.33	6.53	6.56	7.71	1.19	3	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio					**1.94**	**2.19**		**2.43**								**4**	**1**	**1**	**1**	**0.94**	**0.94**	**0.94**	**0.94**		**1**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	15	30	65	11.3	18.65	20.99	21.31		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.017	0.027	0.033	0.018	0.05	0.024	0.134		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	15	20	6.32	12.33	10.63	21.53		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	2	2.25	2.5	0.5	1.13	1.26	1.69		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	70	70	70	36.04	45.42	46.77	53.33		
Pattern																									
Channel Beltwidth (ft)																				58.77	58.77	58.77	58.77		
Radius of Curvature (ft)																				83.8	83.8	83.8	83.8		
Rc:Bankfull width (ft/ft)																				**4.58**	**15.65**	**16.52**	**23.05**		
Meander Wavelength (ft)																									
Meander Width Ratio																				2.55	5.2	3.56	12.83		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.619											0.516				0.199			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							C4						C4					C4				C4			
Bankfull Velocity (fps)							2.73											3.03				3.96			
Bankfull Discharge (cfs)							163																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					1030.85				1079.45			
Sinuosity (ft)							1.13						1.25					1.05				1.01			
Water Surface Slope (Channel) (ft/ft)													0.38												
BF slope (ft/ft)													**0.38**												
[3]Bankfull Floodplain Area (acres)																		**0.49**				**0.074**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data. 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 2 (951 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																	4	4	4	3.52	3.52	3.52	3.52		1
Floodprone Width (ft)																	7	7	7	8.34	8.34	8.34	8.34		1
Bankfull Mean Depth (ft)																	0.47	0.47	0.47	0.52	0.52	0.52	0.52		1
[1]Bankfull Max Depth (ft)																	0.75	0.75	0.75	0.72	0.72	0.72	0.72		1
Bankfull Cross Sectional Area (ft^2)																	1.88	1.88	1.88	1.82	1.82	1.82	1.82		1
Width/Depth Ratio																	8.51	8.51	8.51	6.82	6.82	6.82	6.82		1
Entrenchment Ratio																	1.75	1.75	1.75	2.37	2.37	2.37	2.37		1
[1]Bank Height Ratio																	**1**	**1**	**1**	**1.01**	**1.01**	**1.01**	**1.01**		**1**
Profile																									
Riffle Length (ft)																	51.74	51.74	51.74	6.98	13.52	13.52	20.07		
Riffle Slope (ft/ft)																	0.024	0.024	0.024	0.01	0.013	0.013	0.016		
Pool Length (ft)																				12.76	12.76	12.76	12.76		
Pool Max depth (ft)																				0.89	0.89	0.89	0.89		
Pool Spacing (ft)																				30.63	30.63	30.63	30.63		
Pattern																									
Channel Beltwidth (ft)																									
Radius of Curvature (ft)																									
Rc:Bankfull width (ft/ft)																									
Meander Wavelength (ft)																									
Meander Width Ratio																									
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																	0.571			0.249					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																	B6			B6					
Bankfull Velocity (fps)																				1.66					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																	951			951.37					
Sinuosity (ft)																				0.96					
Water Surface Slope (Channel) (ft/ft)																									
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 3 (1,475 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																	4	4	4	3.5	4.38	3.73	5.91		3
Floodprone Width (ft)																	7	7	7	6.35	14.65	13.14	24.45		3
Bankfull Mean Depth (ft)																	0.47	0.47	0.47	0.2	0.34	0.29	0.53		3
[1]Bankfull Max Depth (ft)																	0.75	0.75	0.75	0.31	0.58	0.61	0.82		3
Bankfull Cross Sectional Area (ft^2)																	1.88	1.88	1.88	0.75	1.43	1.69	1.84		3
Width/Depth Ratio																	8.51	8.51	8.51	6.66	15.31	18.61	20.67		3
Entrenchment Ratio																	1.75	1.75	1.75	1.7	3.64	2.22	6.99		3
[1]Bank Height Ratio																	**1**	**1**	**1**	**0.54**	**0.64**	**0.64**	**0.74**		**3**
Profile																									
Riffle Length (ft)																	197.1	355.9	514.7	57.25	107.8	89.01	215.1		
Riffle Slope (ft/ft)																	0.006	0.012	0.044	0.011	0.017	0.014	0.029		
Pool Length (ft)																				1.5	12.97	6.04	31.37		
Pool Max depth (ft)																				4.14	4.46	4.61	4.62		
Pool Spacing (ft)																				114.3	133.6	143.3	143.3		
Pattern																									
Channel Beltwidth (ft)																	50.42	59.15	61.2	13.4	34.2	42.73	46.46		
Radius of Curvature (ft)																				21.64	35.62	35.15	50.55		
Rc:Bankfull width (ft/ft)																				**2.38**	**15.62**	**14.63**	**30.84**		
Meander Wavelength (ft)																									
Meander Width Ratio																				0.43	5.37	2.44	19.52		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																	0.285			0.29					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																	B6			B6					
Bankfull Velocity (fps)																				1.47					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																	1475			1469.07					
Sinuosity (ft)																				0.95					
Water Surface Slope (Channel) (ft/ft)																				0.019					
BF slope (ft/ft)																				**0.019**					
[3]Bankfull Floodplain Area (acres)																				**0.84**					
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 4 (831 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																				13.32	13.32	13.32	13.32		1
Floodprone Width (ft)																				>50	>50	>50	>50		1
Bankfull Mean Depth (ft)																				0.91	0.91	0.91	0.91		1
[1]Bankfull Max Depth (ft)																				1.71	1.71	1.71	1.71		1
Bankfull Cross Sectional Area (ft^2)																				12.13	12.13	12.13	12.13		1
Width/Depth Ratio																				14.63	14.63	14.63	14.63		1
Entrenchment Ratio																				>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio																				**0.6**	**0.6**	**0.6**	**0.6**		**1**
Profile																									
Riffle Length (ft)																				4.74	19.81	21.81	30.73		
Riffle Slope (ft/ft)																				0.012	0.027	0.018	0.074		
Pool Length (ft)																				6.99	12.56	9.1	26.02		
Pool Max depth (ft)																				1.89	2.28	2.32	2.7		
Pool Spacing (ft)																				50.06	56.72	55.31	68.08		
Pattern																									
Channel Beltwidth (ft)																				80.13	98.47	98.47	116.8		
Radius of Curvature (ft)																				36.7	47.23	49.01	56.95		
Rc:Bankfull width (ft/ft)																				**16.34**	**19.23**	**18.89**	**23.76**		
Meander Wavelength (ft)																				221.95	221.95	221.95	221.95		
Meander Width Ratio																				3.37	5.19	4.91	7.15		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																				1.35					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																				C4b					
Bankfull Velocity (fps)																				4.23					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																				830.01					
Sinuosity (ft)																				0.806					
Water Surface Slope (Channel) (ft/ft)																									
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																				**0.03**					
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 7 (1,127 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					20.47	26.07	26.81	30.18	4.06	4	43.1	52.2	50.6	64.4	8.8	4	25	25	25	18.58	19.65	19.65	20.71		2
Floodprone Width (ft)					39.2	54.4	43.82	90.77	24.57	4	54.9	75.3	74.3	98	15.4	4	>55	>55	>55	>80			>100		2
Bankfull Mean Depth (ft)					0.85	1	1	1.17	0.13	4	0.98	1.16	1.1	1.38	0.18	4	0.98	0.98	0.98	0.96	1.07	1.07	1.17		2
[1]Bankfull Max Depth (ft)					1.79	2.16	1.94	2.95	0.54	4	2.17	2.41	2.5	2.5	0.14	4	1.13	1.13	1.13	1.17	1.43	1.43	1.69		2
Bankfull Cross Sectional Area (ft^2)					19.96	26.07	26.67	31	5.47	4	55.4	59.3	58.7	64.5	3.36	4	24.44	24.44	24.44	19.93	20.81	20.81	21.68		2
Width/Depth Ratio					20.89	26.33	26.3	31.81	5.33	4	31.3	47	46.2	64.4	14.35	4	25.51	25.51	25.51	15.92	18.72	18.72	21.52		2
Entrenchment Ratio					1.45	2.07	1.92	3.01	0.75	4	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		2
[1]Bank Height Ratio																**4**	**1**	**1**	**1**	**0.78**	**0.85**	**0.85**	**0.92**		**2**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	10	35	60	9.79	36.53	37.12	54.31		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.008	0.01	0.01	0.001	0.014	0.013	0.039		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	10	20	8.16	15.87	13.77	28.95		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	1.5	2	2	1	2.05	2.04	2.85		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	15	55	100	13.27	54.36	56.47	130.7		
Pattern																									
Channel Beltwidth (ft)																	201	201	201	154.6	209.3	209.3	264		
Radius of Curvature (ft)																	50	137.5	686	90.88	194.3	125.7	434.9		
Rc:Bankfull width (ft/ft)																	**28**	**31.5**	**31**	**15.71**	**20.53**	**21.99**	**22.62**		
Meander Wavelength (ft)																	720	720	720	687.9	687.9	687.9	687.9		
Meander Width Ratio																	6.48	6.38	7.18	9.838	10.19	9.514	11.67		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.479											0.407				0.358			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							F4/C4						C4					C4				C4			
Bankfull Velocity (fps)							3.7											3.93				4.61			
Bankfull Discharge (cfs)							96																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					1110.53				1126.71			
Sinuosity (ft)													1.25					1.21				1.23			
Water Surface Slope (Channel) (ft/ft)													0.38					0.006				0.006			
BF slope (ft/ft)													**0.38**					**0.006**				**0.005**			
[3]Bankfull Floodplain Area (acres)																		**0.459**				**5.35**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															41.8	25.4	19.4	13.4	0			30.5	14.7	36.8	18	0		
[1]SC% / Sa% / G% / C% / B% / Be%	26	22.1	51.9	0	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.69	2.33	10.3	21.3			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															41.3	13	13	32.7	0			25.8	20.2	26	28	0		
[1]SC% / Sa% / G% / C% / B% / Be%	17	20	41	22	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.06	0.9	12.5	94.2	159			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	5	95	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						98	2	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 4 (969 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	40.9	28.8	11.7	18.6	0																	40.9	28.8	11.7	18.6	0		
[1]SC% / Sa% / G% / C% / B% / Be%	24.8	21	28.6	2.9	1	21.9		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.74	2.75	bedroc	bedrock			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT2 (951 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															100	0	0	0	0			90	2	6	2	0		
[1]SC% / Sa% / G% / C% / B% / Be%								10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	90	10	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						90	10	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT3 (1,475 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															100	0	0	0	0			83.7	3.2	5.5	7.6	0		
[1]SC% / Sa% / G% / C% / B% / Be%								10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	50	30	20	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						80	18	2	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT4 (831 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						43.1	21.2	19.7	16	0		
[1]SC% / Sa% / G% / C% / B% / Be%	10.2	20.4	59.2	0	0	10.2		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.24	2.96	6.85	26.8	bedrock			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT7 (1,127 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															40.7	18.9	15.6	15.1	9.7			34.9	26.1	12.1	18.2	8.7		
[1]SC% / Sa% / G% / C% / B% / Be%	24.3	19.4	50.5	5.8	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.78	3.3	14.3	75.1			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	0	15	85		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						95	5	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 1 (2,305 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	640.21	640.21	640.21	640.21	640.21	640.21		640.24	640.24	640.24	640.24	640.24	640.24	
Bankfull Width (ft)	35.21	36.55	37.70	38.49				35.77	36.90	36.53	37.81			
Floodprone Width (ft)	>80	125.20	135.20	>100				>80	127.00	158.50	>100			
Bankfull Mean Depth (ft)	1.23	1.16	1.15	1.23				1.11	0.97	1.15	1.14			
Bankfull Max Depth (ft)	1.79	1.78	1.96	2.26				2.48	2.03	2.52	2.25			
Bankfull Cross Sectional Area (ft^2)	43.15	42.32	43.25	47.22				39.80	35.60	42.08	43.05			
Bankfull Width/Depth Ratio	28.73	31.56	32.87	31.37				32.15	38.17	31.71	33.21			
Bankfull Entrenchment Ratio	>2.2	3.43	3.59	>2.2				>2.2	3.44	4.34	>2.2			
Bankfull Bank Height Ratio[2]	1.00	0.97	1.09	0.42				0.73	0.88	0.94	0.76			
Cross Sectional Area between end pins (ft^2)	77.79	86.15	88.38	92.57				85.42	81.10	88.9	93.80			
d50 (mm)	15.90	21.00	22.00	81.73				5.00	16.00	11.00	32.00			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 3 (1,083 feet)

	Cross Section 1 (Riffle)-2R							Cross Section 2 (Pool)-2P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	630.92	630.92	630.92	630.92	630.92	630.92		629.80	629.80	629.80	629.80	629.80	629.80	
Bankfull Width (ft)	38.31	41.03	38.35	37.41				39.59	26.70	33.35	37.91			
Floodprone Width (ft)	>90	419.00	488.00	>100				>90	350.00	368.00	99.57			
Bankfull Mean Depth (ft)	1.26	1.25	1.37	1.38				1.11	1.59	1.00	0.92			
Bankfull Max Depth (ft)	1.90	2.18	2.97	2.94				2.44	2.20	2.26	2.26			
Bankfull Cross Sectional Area (ft^2)	48.23	51.15	52.43	51.64				43.79	42.50	33.19	34.92			
Bankfull Width/Depth Ratio	30.43	32.91	28.05	27.10				35.79	16.77	33.52	41.16			
Bankfull Entrenchment Ratio	>2.2	10.21	12.73	>2.2				>2.2	13.11	11.03	2.63			
Bankfull Bank Height Ratio[2]	0.94	1.06	1.38	1.44				0.69	0.72	0.84	0.82			
Cross Sectional Area between end pins (ft^2)	116.34	104.46	103.94	106.00				89.91	77.86	68.32	69.90			
d50 (mm)	31.00	29.00	13.5	49.22				6.70	9.00	14.50	42.83			

NOTE: XS 2R and 2P reshaped as part of MY2 to remove backwater and overflow conditions upstream.

As observed in the method of determining bank height ratio, modifications to the channel in year 2 at XS 2R has created high bank height ratios. This is not a valid characterization of stability at this section with holding by holding the as-built baseline bankfull elevation in determining cross-section characterizations. The channel in this section of restoration is a tiered system and is providing proper floodplain connection to allow waters out of the channel. The work was performed due to backwater conditions caused by this riffle, which was a greater sign of instability.

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 4 (969 feet)

	Cross Section 1 (Pool)-3P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	624.26	624.26	624.26	624.26	624.26	624.26	
Bankfull Width (ft)	29.35	25.94	24.64	22.88			
Floodprone Width (ft)	>65	438.00	435.00	>100			
Bankfull Mean Depth (ft)	1.87	2.38	2.36	2.22			
Bankfull Max Depth (ft)	3.12	3.38	3.32	3.24			
Bankfull Cross Sectional Area (ft^2)	54.90	61.79	58.25	50.77			
Bankfull Width/Depth Ratio	15.69	10.89	10.42	10.32			
Bankfull Entrenchment Ratio	>2.2	16.89	17.65	>2.2			
Bankfull Bank Height Ratio[2]	0.70	0.66	0.73	0.72			
Cross Sectional Area between end pins (ft^2)	106.25	112.61	110.74	99.73			
d50 (mm)	3.40	13.00	19.50	41.75			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 2 (951 feet)

	Cross Section 1 (Riffle)-1R						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	639.34	639.34	639.34	639.34	639.34	639.34	
Bankfull Width (ft)	3.52	6.23	4.31	3.59			
Floodprone Width (ft)	8.34	31.10	40.80	10.96			
Bankfull Mean Depth (ft)	0.52	0.42	0.80	0.9			
Bankfull Max Depth (ft)	0.72	0.96	1.03	1.2			
Bankfull Cross Sectional Area (ft^2)	1.82	2.65	3.43	3.22			
Bankfull Width/Depth Ratio	6.82	14.65	5.42	4			
Bankfull Entrenchment Ratio	2.37	5.00	9.46	>2.2			
Bankfull Bank Height Ratio[2]	1.01	0.86	1.20	1.18			
Cross Sectional Area between end pins (ft^2)	20.73	21.69	20.37	20.83			
d50 (mm)	5.00	silt/clay	silt/clay	5.36			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."
2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT3 (1,475 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Riffle)-2R							Cross Section 3 (Riffle)-3R							Cross Section 4 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	647.14	647.14	647.14	647.14	647.14	647.14		632.79	633.69	633.69	633.69	633.69	633.69		622.92	623.77	623.77	623.77	623.77	623.77		638.72	639.22	639.22	639.22	639.22	639.22	
Bankfull Width (ft)	3.50	5.20	5.42	4.66				5.91	11.93	8.65	13.46				3.73	7.17	8.16	7.29				4.06	8.51	6.87	9.21			
Floodprone Width (ft)	24.45	29.60	27.50	11.22				13.14	31.20	30.20	15.96				6.35	>100	>100	90.60				8.28	20.40	15.30	9.41			
Bankfull Mean Depth (ft)	0.53	0.30	5.42	0.29				0.29	0.99	1.19	0.54				0.20	0.48	0.58	0.55				0.25	0.58	0.46	0.22			
Bankfull Max Depth (ft)	0.82	0.78	0.60	0.64				0.61	1.62	1.56	1.05				0.31	1.05	1.08	1.05				0.46	1.19	0.79	0.51			
Bankfull Cross Sectional Area (ft^2)	1.84	1.55	1.80	1.36				1.69	11.79	10.31	7.29				0.75	3.41	4.75	4.02				1.01	4.90	3.14	2.03			
Bankfull Width/Depth Ratio	6.66	17.47	16.31	16.01				20.67	12.06	7.25	24.84				18.61	15.08	14.02	13.21				16.32	8.51	15.06	41.78			
Bankfull Entrenchment Ratio	6.99	5.70	5.07	>2.2				2.22	2.62	3.49	1.19				1.70	>2.2	>2.2	>2.2				2.04	2.40	2.23	1.02			
Bankfull Bank Height Ratio[2]	0.74	1.04	0.69	0.90				0.57	0.35	0.54	0.82				0.71	0.99	1.03	1.17				0.54	0.46	0.64	0.53			
Cross Sectional Area between end pins (ft^2)	13.50	13.86	15.62	14.11				26.63	32.12	30.79	26.15				15.64	14.90	15.72	13.13				27.61	28.88	24.81	23.54			
d50 (mm)	silt/clay	silt/clay	silt/clay	silt/clay				4.50	0.19	silt/clay	silt/clay				0.11	silt/clay	silt/clay	silt/clay				silt/clay	silt/clay	silt/clay	silt/clay			

NOTE: MY1 Data modified to use same bankfull elevation as baseline data for 1R. MY1 Bankfull for 2R, 3R and 1P established as baseline bankfull as the original bankfull only had slope indications to identify, where MY1 provided more thorough evidence of bankfull.

MY3 field survey bankfull indicates a change in bankfull from baseline elevation. This is expected due to the cattle damage in the channel during MY2. The stream appears more stable in MY3 than in past. Baseline bankful for previous years still used as per North Carolina DMS protocols, but MY3 bankfull elevations are shown on the Cross Section plot exhibits.

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."
2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 4 (831 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	627.41	627.41	627.41	627.41	627.41	627.41		629.84	629.84	629.84	629.84	629.84	629.84	
Bankfull Width (ft)	13.32	13.94	14.33	11.55				20.38	17.20	19.45	18.10			
Floodprone Width (ft)	>50	>100	>100	35.53				>100	>100	>100	77.83			
Bankfull Mean Depth (ft)	0.91	0.89	0.73	0.84				1.34	1.35	1.22	1.32			
Bankfull Max Depth (ft)	1.71	1.65	1.74	1.76				2.71	2.53	2.94	2.64			
Bankfull Cross Sectional Area (ft^2)	12.13	12.35	10.42	9.70				27.37	23.29	23.75	23.94			
Bankfull Width/Depth Ratio	14.63	15.73	19.70	13.75				15.18	12.71	15.93	18.10			
Bankfull Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2				>2.2	>2.2	>2.2	>2.2			
Bankfull Bank Height Ratio[2]	0.60	0.99	1.16	0.80				0.63	0.85	1.07	0.95			
Cross Sectional Area between end pins (ft^2)	29.20	32.81	31.19	29.13				54.73	53.60	54.93	53.03			
d50 (mm)	8.90	6.90	10.00	11.30				7.00	0.18	10.00	41.10			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."
2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 7 (1,127 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Riffle)-2R							Cross Section 3 (Pool)-1P							Cross Section 4 (Step Pool)-STP1							Cross Section 5 (Step Pool)-STP2						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	615.87	615.87	615.87	615.87	615.87	615.87		613.60	613.60	613.60	613.60	613.60	613.60		614.93	614.93	614.93	614.93	614.93	614.93				612.87	612.87	612.87	612.87				610.22	610.22	610.22	610.22	
Bankfull Width (ft)	20.71	21.76	21.47	21.15				18.58	21.20	21.61	18.23				27.10	29.90	23.14	22.65						28.17	26.53						20.56	22.82			
Floodprone Width (ft)	>100	>100	>100	>100				>80	>100	>100	>100				>80	>100	>100	>100						>100	>100						>100	38.67			
Bankfull Mean Depth (ft)	0.96	0.75	0.98	0.86				1.17	1.02	1.21	1.15				0.96	0.81	1.24	1.11						1.86	1.70						1.66	1.37			
Bankfull Max Depth (ft)	1.17	0.92	1.29	1.31				1.69	1.82	2.04	1.78				1.29	1.25	1.53	1.61						2.55	2.32						2.32	2.04			
Bankfull Cross Sectional Area (ft^2)	19.93	16.42	21.15	18.21				21.68	21.71	26.11	21.00				25.98	24.19	28.70	25.11						52.44	44.98						34.22	31.17			
Bankfull Width/Depth Ratio	21.52	28.86	21.80	24.56				15.92	20.70	17.89	15.83				28.27	36.96	18.65	20.43						15.13	15.65						12.35	16.71			
Bankfull Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2				>2.2	>2.2	>2.2	>2.2				>2.2	>2.2	>2.2	>2.2						>2.2	>2.2						>2.2	1.69			
Bankfull Bank Height Ratio[2]	0.78	0.84	0.96	1.24				0.92	1.25	1.12	0.97				0.67	1.23	0.80	1.03						0.92	0.92						0.78	0.50			
Cross Sectional Area between end pins (ft^2)	66.61	65.98	73.43	67.07				52.17	56.85	61.51	55.95				76.83	80.07	90.25	81.55						149.86	133.36						200.48	197.13			
d50 (mm)	23.00	11.00	18.00	36.00				0.50	0.50	20.00	27.84				silt/clay	silt/clay	silt/clay	silt/clay						49.00	39.22						30.00	41.10			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Bankfull Bank Height Ratio is determined yearly by maintaining the baseline banfull max depth static while using the monitoring year lowest bank height surveyed. This method is selected based on the overall evaluation method preferred by DMS in which the yearly cross-section parmaters are compared to the as-built baseline bankfull datum.

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	35.21	35.21	35.21	35.21		1	36.55	36.55	36.55	36.55		1	37.7	37.7	37.7	37.7		1	38.49	38.49	38.49	38.49		1												
Floodprone Width (ft)	>80	>80	>80	>80		1	125.20	125.20	125.20	125.20		1	135.2	135.2	135.2	135.2		1	>100	>100	>100	>100		1												
Bankfull Mean Depth (ft)	1.23	1.23	1.23	1.23		1	1.16	1.16	1.16	1.16		1	1.15	1.15	1.15	1.15		1	1.23	1.23	1.23	1.23		1												
[1]Bankfull Max Depth (ft)	1.79	1.79	1.79	1.79		1	1.78	1.78	1.78	1.78		1	1.96	1.96	1.96	1.96		1	2.26	2.26	2.26	2.26		1												
Bankfull Cross Sectional Area (ft²)	43.15	43.15	43.15	43.15		1	42.32	42.32	42.32	42.32		1	43.25	43.25	43.25	43.25		1	47.22	47.22	47.22	47.22		1												
Width/Depth Ratio	28.73	28.73	28.73	28.73		1	31.56	31.56	31.56	31.56		1	32.87	32.87	32.87	32.87		1	31.37	31.37	31.37	31.37		1												
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	3.43	3.43	3.43	3.43		1	3.59	3.59	3.59	3.59		1	>2.2	>2.2	>2.2	>2.2		1												
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**1**	**0.97**	**0.97**	**0.97**	**0.97**		**1**	**1.09**	**1.09**	**1.09**	**1.09**		**1**	**0.42**	**0.42**	**0.42**	**0.42**		1												
Profile																																				
Riffle Length (ft)	7.73	23.71	22.04	38.44			5.02	14.18	9.18	31.54			8.88	15.73	16.57	20.64			12.59	16.66	14.88	21.37														
Riffle Slope (ft/ft)	0.00	0.026	0.022	0.076			0.001	0.015	0.007	0.044			0.004	0.016	0.006	0.062			0.004	0.022	0.021	0.044														
Pool Length (ft)	4.21	25.43	17.55	83.2			2.96	7.07	6.1	14.54			6.82	22.35	21.04	39.29			9.78	27.54	24.39	48.90														
Pool Max depth (ft)	1.96	2.71	2.48	3.76			1.96	2.63	2.43	3.42			2.10	2.53	2.37	3.75			1.33	1.65	1.48	2.55														
Pool Spacing (ft)	29.95	48.64	39.06	91.87			14.66	32.47	23.01	54.64			21.81	33.95	34.70	46.54			28.90	40.23	40.13	51.92														
Pattern																																				
Channel Beltwidth (ft)	59.64	105.83	92.68	165.18																																
Radius of Curvature (ft)	72.965	83.153	79.01	97.485																																
Rc:Bankfull width (ft/ft)	**27.95**	**35.603**	**36.13**	**46.36**																																
Meander Wavelength (ft)																																				
Meander Width Ratio	1.2865	3.037	2.5652	5.9098																																
Additional Reach Parameters																																				
Rosgen Classification	C4						C4c-						C4						C4																	
Channel Thalweg length (ft)	2299.79						2318.86						2306.75						2305.11																	
Sinuosity (ft)	1.05						1.05						1.05						1.05																	
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						NA (DRY/STAGNET WATER)						0.0015 (BACKWATER-BEAVER DAM)																	
BF slope (ft/ft)							**0.0007**						**0.0014**						**0.0027**																	
[3]Ri% / Ru% / P% / G% / S%	**30.5**	**14.7**	**36.8**	**18**	**0**		**35.2**	**19.6**	**19.5**	**25.6**	**0**		**25.7**	**12.3**	**36.5**	**25.5**	**0**		**22.6**	**15.4**	**37.4**	**24.6**	**0**													
[3]SC% / Sa% / G% / C% / B% / Be%													**0**	**0**	**76.6**	**0**	**0**	**23.4**	**7**	**0**	**82.7**	**0**	**0**	**10.3**											
[3]d16 / d35 / d50 / d84 / d95 /													**0.78**	**10**	**17.5**	**45**	**Bed**		**14.72**	**27.09**	**41.24**	**Bed**	**Bed**												
[2]% of Reach with Eroding Banks							**0**																													
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	38.31	38.31	38.31	38.31		1	41.03	41.03	41.03	41.03		1	38.35	38.35	38.35	38.35		1	23.08	23.08	23.08	23.08		1												
Floodprone Width (ft)	>90	>90	>90	>90		1	419.00	419.00	419.00	419.00		1	488	488	488	488		1	>100	>100	>100	>100		1												
Bankfull Mean Depth (ft)	1.26	1.26	1.26	1.26		1	1.25	1.25	1.25	1.25		1	1.37	1.37	1.37	1.37		1	2.24	2.24	2.24	2.24		1												
[1]Bankfull Max Depth (ft)	1.9	1.9	1.9	1.9		1	2.18	2.18	2.18	2.18		1	2.97	2.97	2.97	2.97		1	2.94	2.94	2.94	2.94		1												
Bankfull Cross Sectional Area (ft^2)	48.23	48.23	48.23	48.23		1	51.15	51.15	51.15	51.15		1	52.43	52.43	52.43	52.43		1	51.64	51.64	51.64	51.64		1												
Width/Depth Ratio	30.43	30.43	30.43	30.43		1	32.91	32.91	32.91	32.91		1	28.05	28.05	28.05	28.05		1	10.31	10.31	10.31	10.31		1												
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	10.21	10.21	10.21	10.21		1	12.73	12.73	12.73	12.73		1	>2.2	>2.2	>2.2	>2.2		1												
[1]Bank Height Ratio	**0.94**	**0.94**	**0.94**	**0.94**		**1**	**1.06**	**1.06**	**1.06**	**1.06**		**1**	**1.38**	**1.38**	**1.38**	**1.38**		**1**	**1.44**	**1.44**	**1.44**	**1.44**		**1**												
Profile																																				
Riffle Length (ft)	11.3	18.65	20.99	21.31			10.65	25.52	26.64	38.18			6.30	20.06	16.55	40.86		1	11.81	23.48	23.48	35.15														
Riffle Slope (ft/ft)	0.0182	0.0502	0.0241	0.1345			0.007	0.013	0.008	0.027			0.008	0.022	0.022	0.037		1	0.008	0.011	0.011	0.015														
Pool Length (ft)	6.32	12.33	10.63	21.53			7.42	17.75	21.33	24.51			2.19	20.09	4.60	68.96		1	8.91	19.63	24.99	64.83														
Pool Max depth (ft)	0.5	1.13	1.26	1.69			1.75	2.81	1.87	4.81			2.70	2.88	2.79	3.23		1	2.68	4.12	2.98	6.69														
Pool Spacing (ft)	36.04	45.42	46.77	53.33			48.94	61.06	51.44	82.8			16.88	40.66	30.84	84.05		1	2.21	39.18	30.57	93.38														
Pattern																																				
Channel Beltwidth (ft)	58.77	58.77	58.77	58.77																																
Radius of Curvature (ft)	83.8	83.8	83.8	83.8																																
Rc:Bankfull width (ft/ft)	**4.58**	**15.654**	**16.52**	**23.05**																																
Meander Wavelength (ft)																																				
Meander Width Ratio	2.5497	5.1978	3.5575	12.832																																

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4						C4																	
Channel Thalweg length (ft)	1079.45						1069.58						1074.38						1075.39																	
Sinuosity (ft)	1.01						1.01						1.01						1.01																	
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						0.002						0.0013																	
BF slope (ft/ft)							**0.0138**						**0.0084**						**0.007**																	
[3]Rl% / Ru% / P% / G% / S%	**25.8**	**20.2**	**26**	**28**	**0**		**42**	**14.4**	**21.9**	**21.7**	**0**		**33**	**9.9**	**33.1**	**24**	**0**		**20.8**	**13.3**	**54.8**	**11.1**	**0**													
[3]SC% / Sa% / G% / C% / B% / Be%													**13.7**	**0**	**78.7**	**0**	**0**	**7.6**	**0**	**0**	**100**	**0**	**0**	**0**												
[3]d16 / d35 / d50 / d84 / d95 /													**2.5**	**9**	**14**	**25**	**38**		**23.69**	**36.14**	**45**	**77.57**	**90**													
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 2 (951 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	3.52	3.52	3.52	3.52		1	6.23	6.23	6.23	6.23		1	4.31	4.31	4.31	4.31		1	3.59	3.59	3.59	3.59		1												
Floodprone Width (ft)	8.34	8.34	8.34	8.34		1	31.10	31.10	31.10	31.10		1	40.8	40.8	40.8	40.8		1	10.96	10.96	10.96	10.96		1												
Bankfull Mean Depth (ft)	0.52	0.52	0.52	0.52		1	0.42	0.42	0.42	0.42		1	0.8	0.8	0.8	0.8		1	0.90	0.90	0.90	0.90		1												
[1]Bankfull Max Depth (ft)	0.72	0.72	0.72	0.72		1	0.96	0.96	0.96	0.96		1	1.03	1.03	1.03	1.03		1	1.20	1.20	1.20	1.20		1												
Bankfull Cross Sectional Area (ft^2)	1.82	1.82	1.82	1.82		1	2.65	2.65	2.65	2.65		1	3.43	3.43	3.43	3.43		1	3.22	3.22	3.22	3.22		1												
Width/Depth Ratio	6.82	6.82	6.82	6.82		1	14.65	14.65	14.65	14.65		1	5.42	5.42	5.42	5.42		1	4.00	4.00	4.00	4.00		1												
Entrenchment Ratio	2.37	2.37	2.37	2.37		1	5.00	5.00	5.00	5.00		1	9.46	9.46	9.46	9.46		1	>2.2	>2.2	>2.2	>2.2		1												
[1]Bank Height Ratio	**1.01**	**1.01**	**1.01**	**1.01**		**1**	**0.86**	**0.86**	**0.86**	**0.86**		**1**	**1.2**	**1.2**	**1.2**	**1.2**		**1**	**1.18**	**1.18**	**1.18**	**1.18**		**1**												
Profile																																				
Riffle Length (ft)	6.98	13.52	13.52	20.07			35.95	35.95	35.95	35.95			18.87	20.43	20.43	21.99			9.18	11.88	11.88	14.58														
Riffle Slope (ft/ft)	0.01	0.013	0.013	0.016			0.008	0.008	0.008	0.008			0.019	0.022	0.022	0.026			0.004	0.019	0.019	0.034														
Pool Length (ft)	12.76	12.76	12.76	12.76			NA	NA	NA	NA			7.71	11.145	11.145	14.58			8.52	8.52	8.52	8.52														
Pool Max depth (ft)	0.89	0.89	0.89	0.89			NA	NA	NA	NA			0.725	1.0875	1.0875	1.45			1.38	1.38	1.38	1.38														
Pool Spacing (ft)	30.63	30.63	30.63	30.63			NA	NA	NA	NA			36.22	36.22	36.22	36.22			NA	NA	NA	NA														
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	B6						B6						B6						B4c																	
Channel Thalweg length (ft)	951.37						951.54						952.31						952.33																	
Sinuosity (ft)	0.96						0.96						0.96						0.96																	
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						NA (DRY)						0.0104																	
BF slope (ft/ft)							**0.0482**						**0.0209**						**0.0113**																	
[3]Ri% / Ru% / P% / G% / S%	**90**	**2**	**6**	**2**	**0**		**100**	**0**	**0**	**0**	**0**		**47.1**	**22.5**	**25.7**	**4.7**	**0**		**46.8**	**24.8**	**16.8**	**11.6**	**0**													
[3]SC% / Sa% / G% / C% / B% / Be%													**14.7**	**53.9**	**0**	**0**	**0**	**31.4**	**21.8**	**11.6**	**66.6**	**0**	**0**	**0**												
[3]d16 / d35 / d50 / d84 / d95 /													**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**		**Silt/Clay**	**0.83**	**5.36**	**Bed**	**Bed**													
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 3 (1,475 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	3.5	4.38	3.73	5.91		3	5.20	8.10	7.17	11.93		3	5.42	7.41	8.16	8.65		3	4.66	8.47	7.29	13.46		3												
Floodprone Width (ft)	6.35	14.65	13.14	24.45		3	29.60	30.40	30.40	>100		3	27.5	28.85	28.85	>100		3	11.22	39.26	15.96	90.60		3												
Bankfull Mean Depth (ft)	0.2	0.34	0.29	0.53		3	0.30	0.59	0.48	0.99		3	0.58	2.40	1.19	5.42		3	0.29	0.46	0.54	0.55		3												
[1]Bankfull Max Depth (ft)	0.31	0.58	0.61	0.82		3	0.78	1.15	1.05	1.62		3	0.6	1.08	1.08	1.56		3	0.64	0.91	1.05	1.05		3												
Bankfull Cross Sectional Area (ft^2)	0.75	1.43	1.69	1.84		3	1.55	5.58	3.41	11.79		3	1.8	5.62	4.75	10.31		3	1.36	4.22	4.02	7.29		3												
Width/Depth Ratio	6.66	15.31	18.61	20.67		3	12.06	14.87	15.08	17.47		3	7.25	12.53	14.02	16.31		3	13.21	18.02	16.01	24.84		3												
Entrenchment Ratio	1.7	3.64	2.22	6.99		3	2.62	4.16	4.16	5.70		3	3.49	4.28	4.28	5.07		3	1.19	1.19	1.19	1.19		3												
[1]Bank Height Ratio	**0.57**	**0.67**	**0.71**	**0.74**		**3**	**0.35**	**0.79**	**0.99**	**1.04**		**3**	**0.54**	**0.75**	**0.69**	**1.03**		**3**	**0.82**	**0.96**	**0.90**	**1.17**		**3**												
Profile																																				
Riffle Length (ft)	57.25	107.81	89.01	215.05			31.91	81.09	72.62	143.24			Not Identifiable due to cattle damage						10.98	57.75	51.85	109.87														
Riffle Slope (ft/ft)	0.011	0.017	0.014	0.029			0.001	0.016	0.016	0.03									0.006	0.019	0.019	0.033														
Pool Length (ft)	1.5	12.97	6.04	31.37			6.73	16.17	12.09	33.76									2.00	9.44	9.13	21.10														
Pool Max depth (ft)	4.14	4.46	4.61	4.62			0.63	1.48	1.48	2.31									0.31	1.26	1.40	2.06														
Pool Spacing (ft)	114.27	133.63	143.31	143.31			125.06	186.72	186.72	248.38									26.92	80.80	77.14	123.04														
Pattern																																				
Channel Beltwidth (ft)	13.4	34.2	42.73	46.46																																
Radius of Curvature (ft)	21.64	35.62	35.15	50.55																																
Rc:Bankfull width (ft/ft)	**2.38**	**15.62**	**14.63**	**30.84**									Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline																							
Meander Wavelength (ft)																																				
Meander Width Ratio	0.43	5.37	2.44	19.52																																
Additional Reach Parameters																																				
Rosgen Classification	B6						B6c						B6						B6																	
Channel Thalweg length (ft)	1469.07						1467.05						1471.15						1484.42																	
Sinuosity (ft)	0.95						0.95						0.95						0.95																	
Water Surface Slope (Channel) (ft/ft)	0.019						NA (DRY)						NA (DRY)						NA (NO VISUAL FLOW BUT SATURATED)																	
BF slope (ft/ft)	**0.019**						**0.0198**						**0.0249**						**0.0167**																	
[3]Rl% / Ru% / P% / G% / S%	**83.7**	**3.2**	**5.5**	**7.6**	**0**		**83.2**	**4.2**	**7.4**	**4.9**	**0.3**		**Not Identifiable due to cattle damage**						**69.7**	**10.7**	**9.5**	**10.1**	**0**														
[3]SC% / Sa% / G% / C% / B% / Be%													**92.3**	**4.7**	**1.6**	**0**	**0**	**1.4**	**94.3**	**3.5**	**0**	**0**	**0**	**2.2**												
[3]d16 / d35 / d50 / d84 / d95 /													**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**		**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**													
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 4 (831 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	13.32	13.32	13.32	13.32		1	13.94	13.94	13.94	13.94		1	14.32691	14.32691	14.32691	14.32691		1	11.55	11.55	11.55	11.55		1												
Floodprone Width (ft)	>50	>50	>50	>50		1	>100	>100	>100	>100		1	>100	>100	>100	>100		1	35.53	35.53	35.53	35.53		1												
Bankfull Mean Depth (ft)	0.91	0.91	0.91	0.91		1	0.89	0.89	0.89	0.89		1	0.73	0.73	0.73	0.73		1	0.84	0.84	0.84	0.84		1												
[1]Bankfull Max Depth (ft)	1.71	1.71	1.71	1.71		1	1.65	1.65	1.65	1.65		1	1.738	1.738	1.738	1.738		1	1.76	1.76	1.76	1.76		1												
Bankfull Cross Sectional Area (ft^2)	12.13	12.13	12.13	12.13		1	12.35	12.35	12.35	12.35		1	10.42	10.42	10.42	10.42		1	9.70	9.70	9.70	9.70		1												
Width/Depth Ratio	14.63	14.63	14.63	14.63		1	15.73	15.73	15.73	15.73		1	19.7	19.7	19.7	19.7		1	13.75	13.75	13.75	13.75		1												
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	>2.2	>2.2	>2.2	>2.2		1	>2.2	>2.2	>2.2	>2.2		1	>2.2	>2.2	>2.2	>2.2		1												
[1]Bank Height Ratio	**0.60**	**0.60**	**0.60**	**0.60**		**1**	**0.99**	**0.99**	**0.99**	**0.99**		**1**	**1.16**	**1.16**	**1.16**	**1.16**		**1**	**0.80**	**0.80**	**0.80**	**0.80**		**1**												
Profile																																				
Riffle Length (ft)	4.74	19.81	21.81	30.73			11.72	23.29	21.67	36.64			4.04	13.83	11.615	30.23			3.55	15.06	10.92	37.19														
Riffle Slope (ft/ft)	0.012	0.027	0.018	0.074			0.013	0.025	0.024	0.037			0.005	0.036	0.035	0.070			0.005	0.034	0.025	0.072														
Pool Length (ft)	6.99	12.56	9.1	26.02			6.8	9.62	8.54	15.58			3.41	6.15	5.915	10.44			1.93	5.72	4.41	12.47														
Pool Max depth (ft)	1.89	2.28	2.32	2.7			1.71	2.42	2.52	2.88			1.835	2.679833	2.731	3.385			1.74	2.20	2.15	2.74														
Pool Spacing (ft)	50.06	56.72	55.31	68.08			22.59	37.51	42.3	46.92			7.58	27.92818	26.45	52			14.21	32.41	31.88	48.40														
Pattern																																				
Channel Beltwidth (ft)	80.13	98.47	98.47	116.81																																
Radius of Curvature (ft)	36.7	47.23	49.01	56.95																																
Rc:Bankfull width (ft/ft)	**16.34**	**19.23**	**18.89**	**23.76**																																
Meander Wavelength (ft)	221.95	221.95	221.95	221.95																																
Meander Width Ratio	3.37	5.19	4.91	7.15																																

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4b						C4						C4						C4																	
Channel Thalweg length (ft)	830.01						837.13						838.29						838.81																	
Sinuosity (ft)	0.81						0.81						0.81						0.81																	
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						0.0138						0.014																	
BF slope (ft/ft)							**0.0123**						**0.0123**						**0.0132**																	
[3]Rl% / Ru% / P% / G% / S%	**43.1**	**21.2**	**19.7**	**16**	**0**		**52.2**	**9.8**	**19.2**	**18.8**	**0**		**34**	**17.9**	**18.1**	**30**	**0**		**41.2**	**23.9**	**14.2**	**20.6**	**0**													
[3]SC% / Sa% / G% / C% / B% / Be%													**0**	**1.7**	**98.3**	**0**	**0**	**0**	**0**	**2.1**	**97.9**	**0**	**0**	**0**											
[3]d16 / d35 / d50 / d84 / d95 /													**0.38**	**5**	**10**	**30**	**64**		**0.96**	**12.95**	**25.21**	**66.50**	**140.13**												
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 7 (1,127 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	18.58	19.65	19.65	20.71		2	21.20	21.48	21.48	21.76		2	21.47	21.54	21.54	21.61		2	18.23	19.69	19.69	21.15		2												
Floodprone Width (ft)	>80			>100		2	>100	>100	>100	>100		2	>100	>100	>100	>100		2	>100	>100	>100	>100		2												
Bankfull Mean Depth (ft)	0.96	1.07	1.07	1.17		2	0.75	0.89	0.89	1.02		2	0.98	1.10	1.10	1.21		2	0.86	1.01	1.01	1.15		2												
[1]Bankfull Max Depth (ft)	1.17	1.43	1.43	1.69		2	0.92	1.37	1.37	1.82		2	1.29	1.67	1.67	2.04		2	1.31	1.55	1.55	1.78		2												
Bankfull Cross Sectional Area (ft^2)	19.93	20.81	20.81	21.68		2	16.42	19.07	19.07	21.71		2	21.15	23.63	23.63	26.11		2	18.21	19.61	19.61	21.00		2												
Width/Depth Ratio	15.92	18.72	18.72	21.52		2	20.70	24.78	24.78	28.86		2	17.89	19.85	19.85	21.80		2	15.83	20.20	20.20	24.56		2												
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		2	>2.2	>2.2	>2.2	>2.2		2	>2.2	>2.2	>2.2	>2.2		2	>2.2	>2.2	>2.2	>2.2		2												
[1]Bank Height Ratio	**0.78**	**0.85**	**0.85**	**0.92**		**2**	**0.84**	**1.05**	**1.05**	**1.25**		**2**	**0.96**	**1.04**	**1.04**	**1.12**		**2**	**0.97**	**1.11**	**1.11**	**1.24**		**2**												
Profile																																				
Riffle Length (ft)	9.79	36.53	37.12	54.31			9.14	29.70	30.63	67.19			8.10	26.04	26.01	42.49			10.09	24.33	24.79	48.87														
Riffle Slope (ft/ft)	0.001	0.014	0.013	0.039			0.001	0.013	0.010	0.051			0.0005	0.012	0.010	0.022			0.002	0.019	0.014	0.064														
Pool Length (ft)	8.16	15.87	13.77	28.95			4.08	13.77	14.49	22.02			5.80	16.74	14.35	34.69			6.43	19.08	16.76	46.09														
Pool Max depth (ft)	1	2.05	2.04	2.85			1.19	1.94	2.00	2.62			1.61	2.25	2.15	3.11			6.43	1.95	1.91	3.96														
Pool Spacing (ft)	13.27	54.36	56.47	130.67			13.50	54.60	58.53	94.06			32.29	56.33	54.12	82.92			6.63	43.62	40.83	80.17														
Pattern																																				
Channel Beltwidth (ft)	154.56	209.27	209.27	263.98																																
Radius of Curvature (ft)	90.88	194.28	125.65	434.94																																
Rc:Bankfull width (ft/ft)	**15.71**	**20.53**	**21.99**	**22.62**																																
Meander Wavelength (ft)	687.9	687.9	687.9	687.9																																
Meander Width Ratio	9.8383	10.191	9.5145	11.67																																

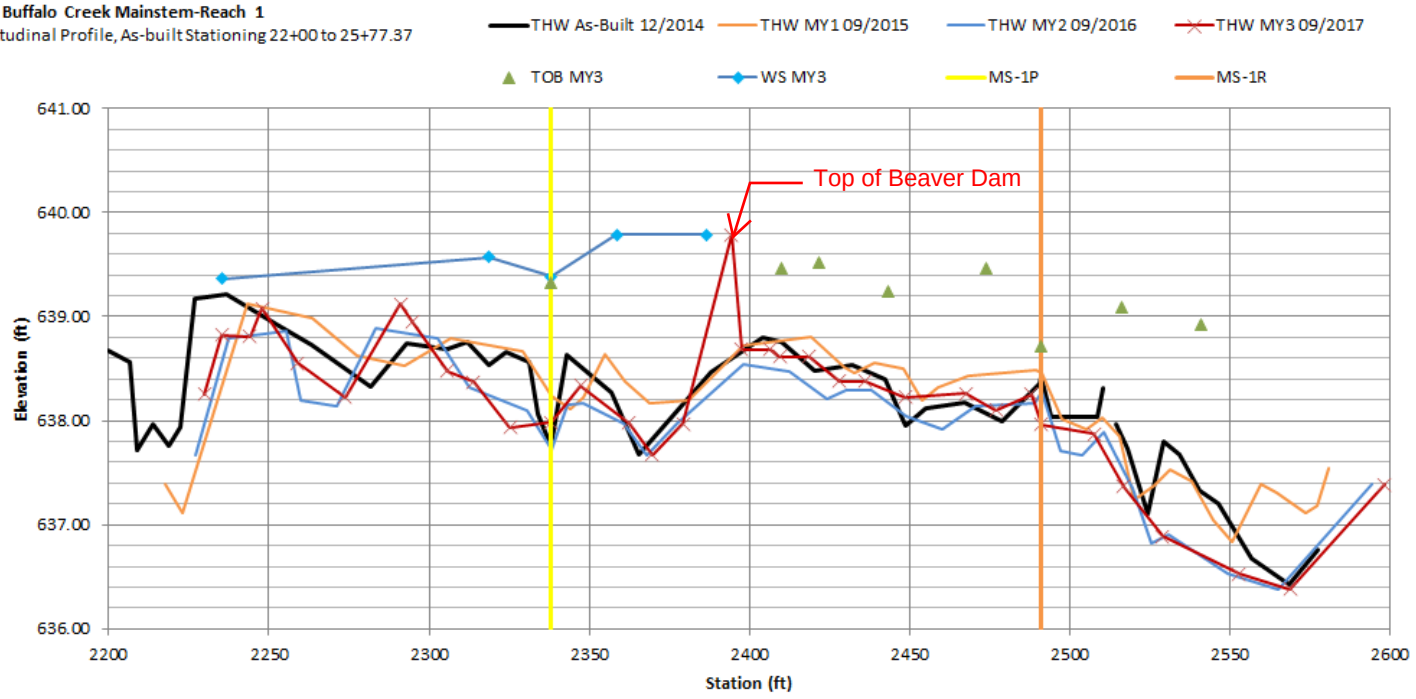
Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4						C4																	
Channel Thalweg length (ft)	1126.71						1140.94						1154.67						1143.65																	
Sinuosity (ft)	1.23						1.23						1.23						1.23																	
Water Surface Slope (Channel) (ft/ft)	0.006						NA (DRY)						NA (DRY)						NA (DRY)																	
BF slope (ft/ft)	**0.005**						**0.0053**						**0.0068**						**0.0064**																	
[3]Rl% / Ru% / P% / G% / S%	**34.9**	**26.1**	**12.1**	**18.2**	**8.7**		**41.1**	**13.7**	**17.6**	**17.4**	**10.2**		**30.1**	**14.3**	**24.7**	**25.1**	**5.8**		**25.0**	**17.4**	**28.4**	**22.8**	**6.3**													
[3]SC% / Sa% / G% / C% / B% / Be%													**21.8**	**17.9**	**45.5**	**12.5**	**1.7**	**0.6**	**29.9**	**0**	**68.9**	**0**	**1.2**	**0**												
[3]d16 / d35 / d50 / d84 / d95 /													**N/A**	**8**	**17.5**	**50**	**100**		**N/A**	**18.82**	**32.67**	**61.10**	**98.87**													
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

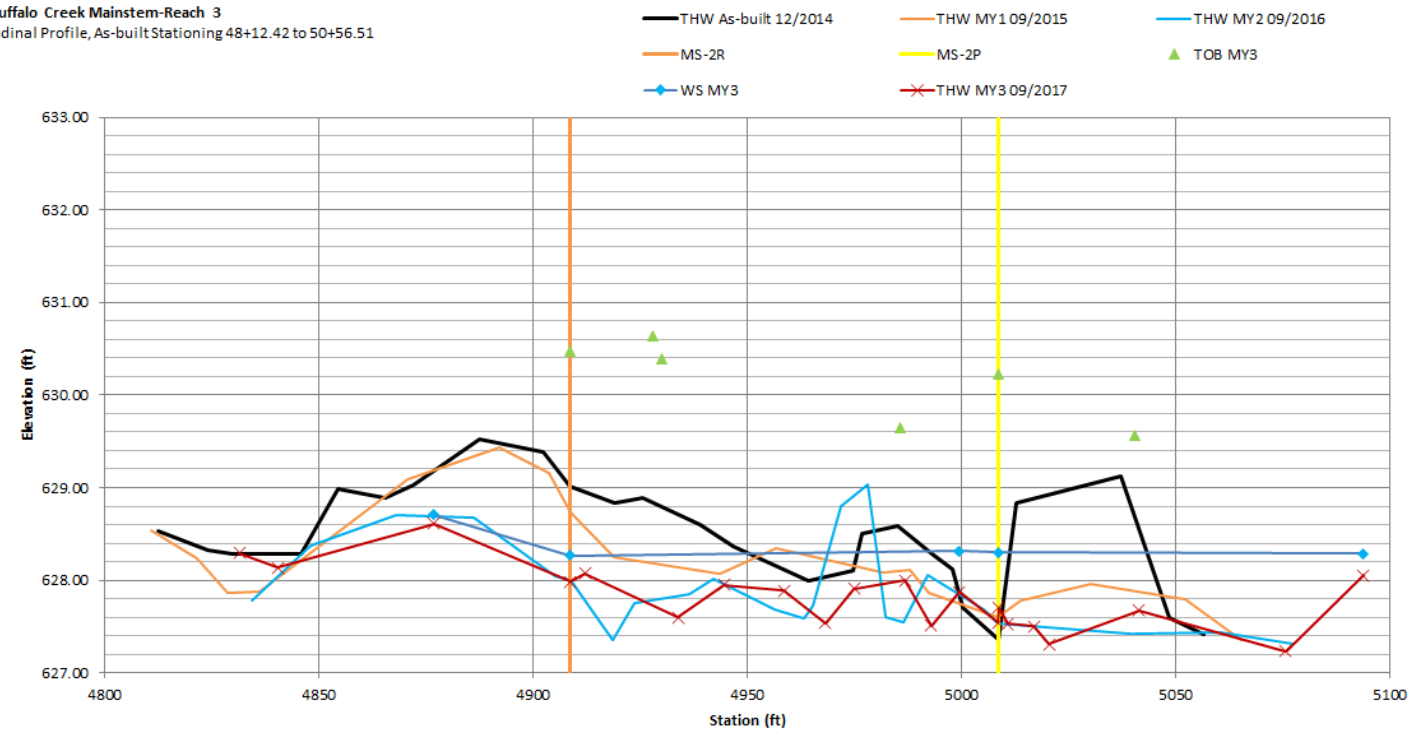
Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

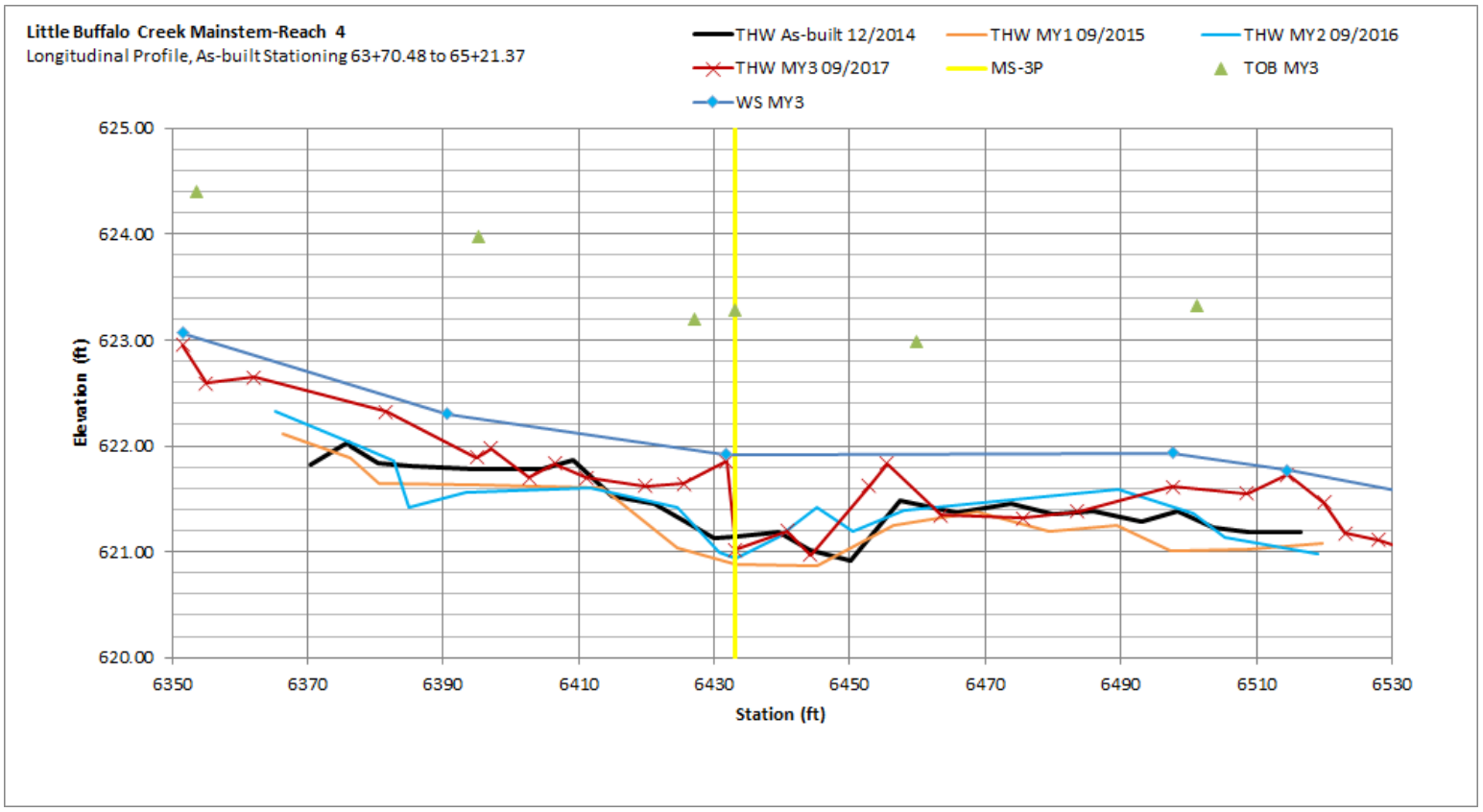
Figures 3a-k – Longitudinal Profile Plots

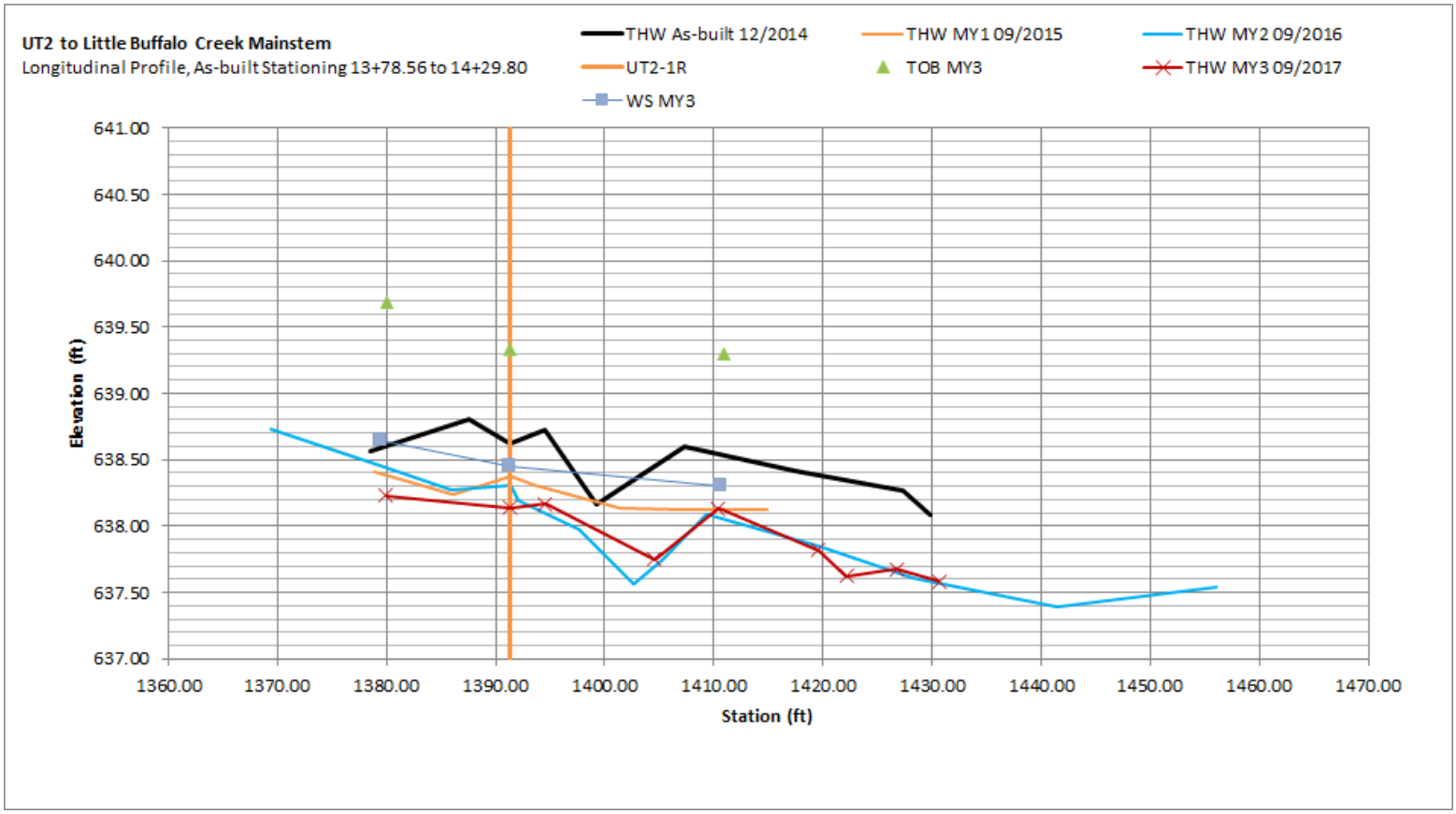
Little Buffalo Creek Mainstem-Reach 1
Longitudinal Profile, As-built Stationing 22+00 to 25+77.37

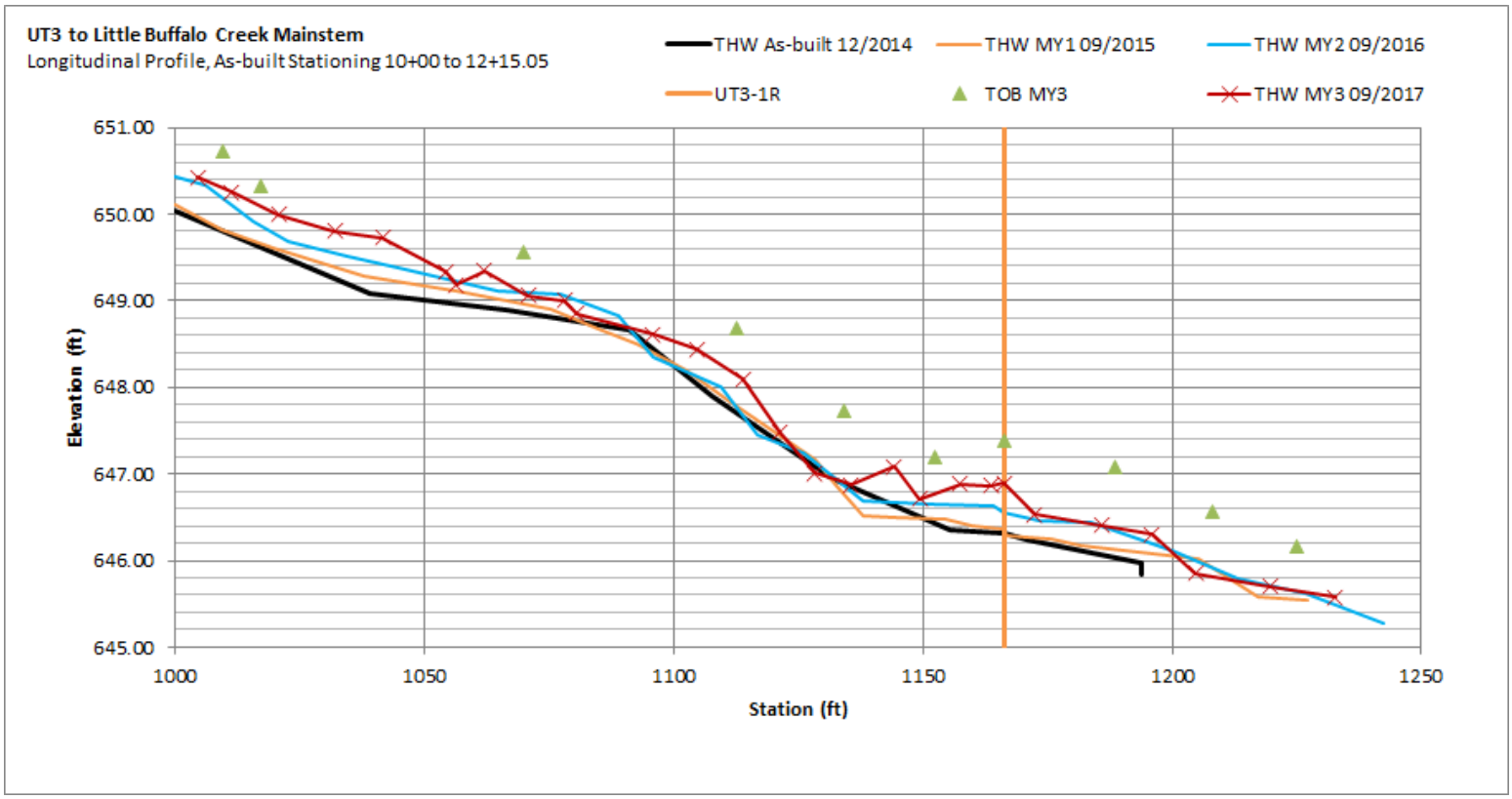


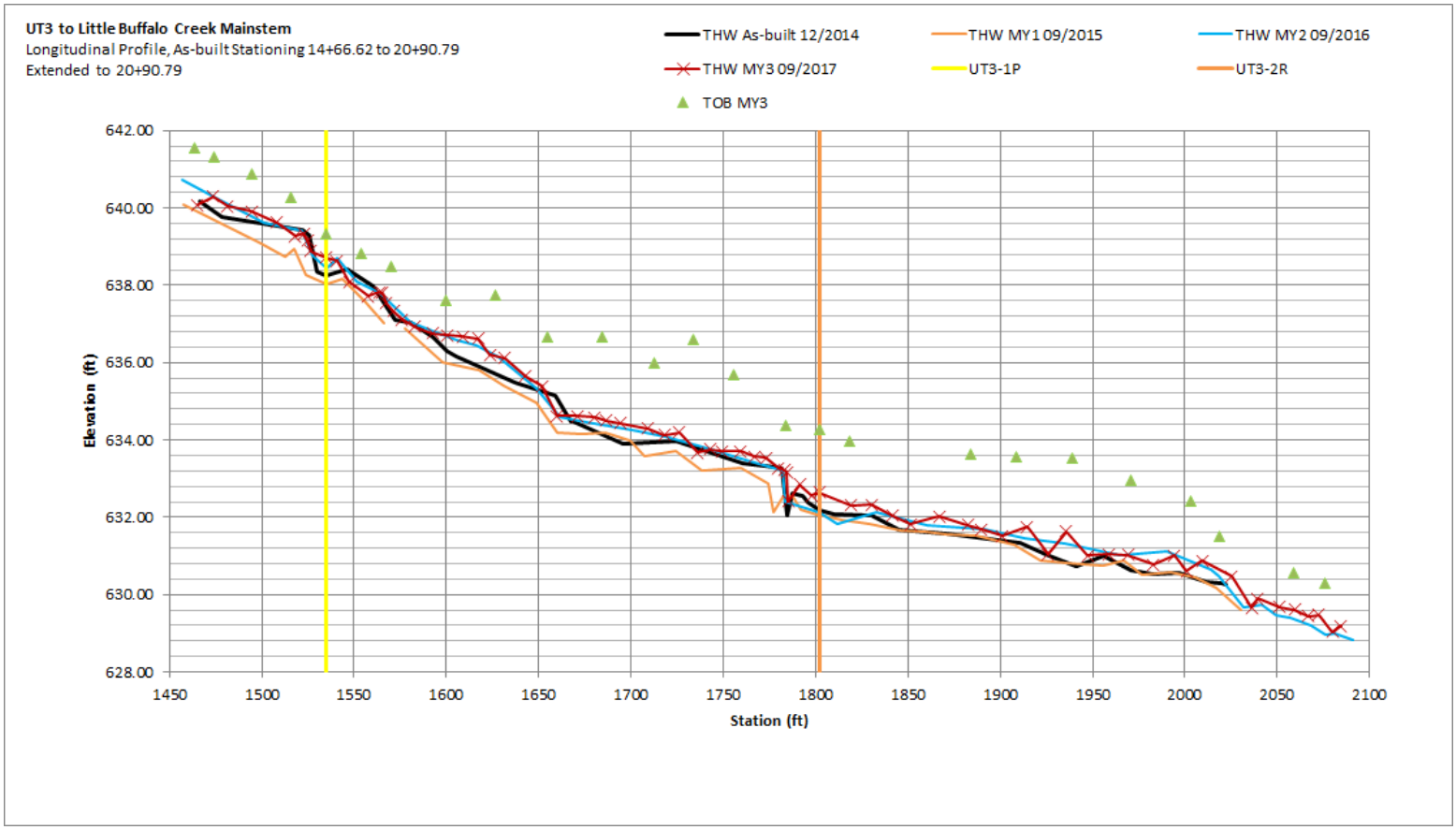
Little Buffalo Creek Mainstem-Reach 3
Longitudinal Profile, As-built Stationing 48+12.42 to 50+56.51



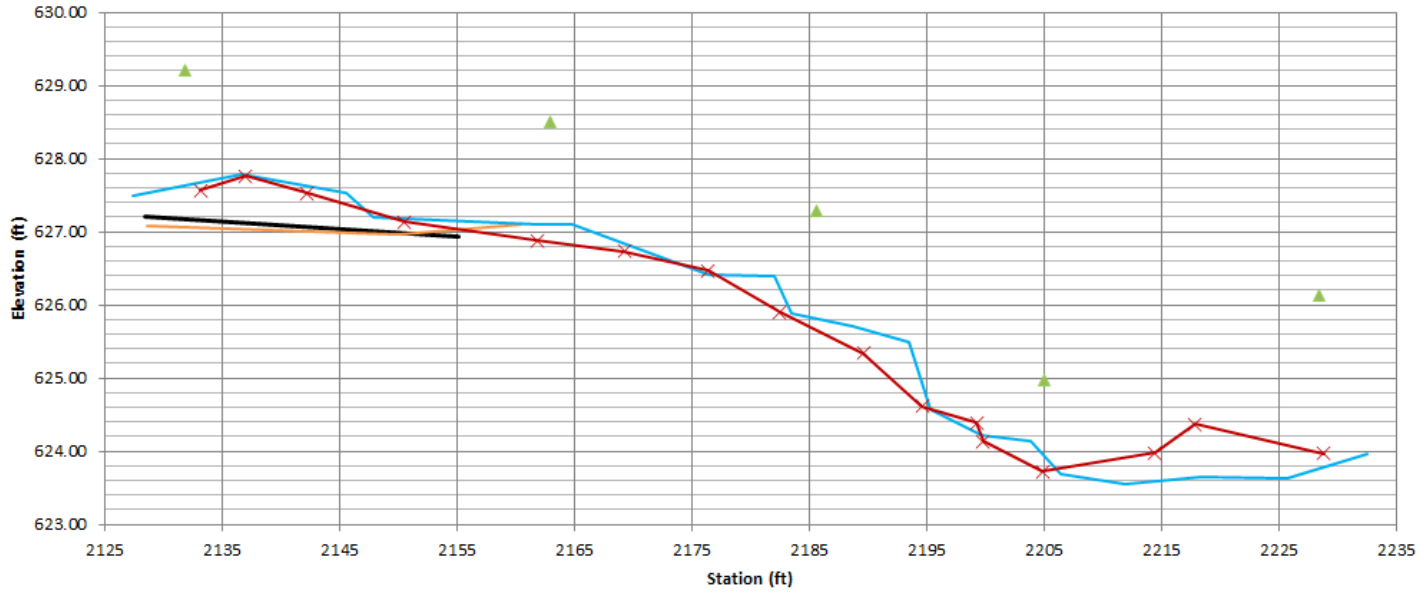

Little Buffalo Creek Mainstem-Reach 4
Longitudinal Profile, As-built Stationing 63+70.48 to 65+21.37
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
THW MY3 09/2017
MS-3P
TOB MY3
WS MY3
625.00
624.00
623.00
622.00
621.00
620.00
Elevation (ft)
6350
6370
6390
6410
6430
6450
6470
6490
6510
6530
Station (ft)


UT2 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 13+78.56 to 14+29.80
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT2-1R
TOB MY3
THW MY3 09/2017
WS MY3
641.00
640.50
640.00
639.50
639.00
638.50
638.00
637.50
637.00
Elevation (ft)
1360.00
1370.00
1380.00
1390.00
1400.00
1410.00
1420.00
1430.00
1440.00
1450.00
1460.00
1470.00
Station (ft)

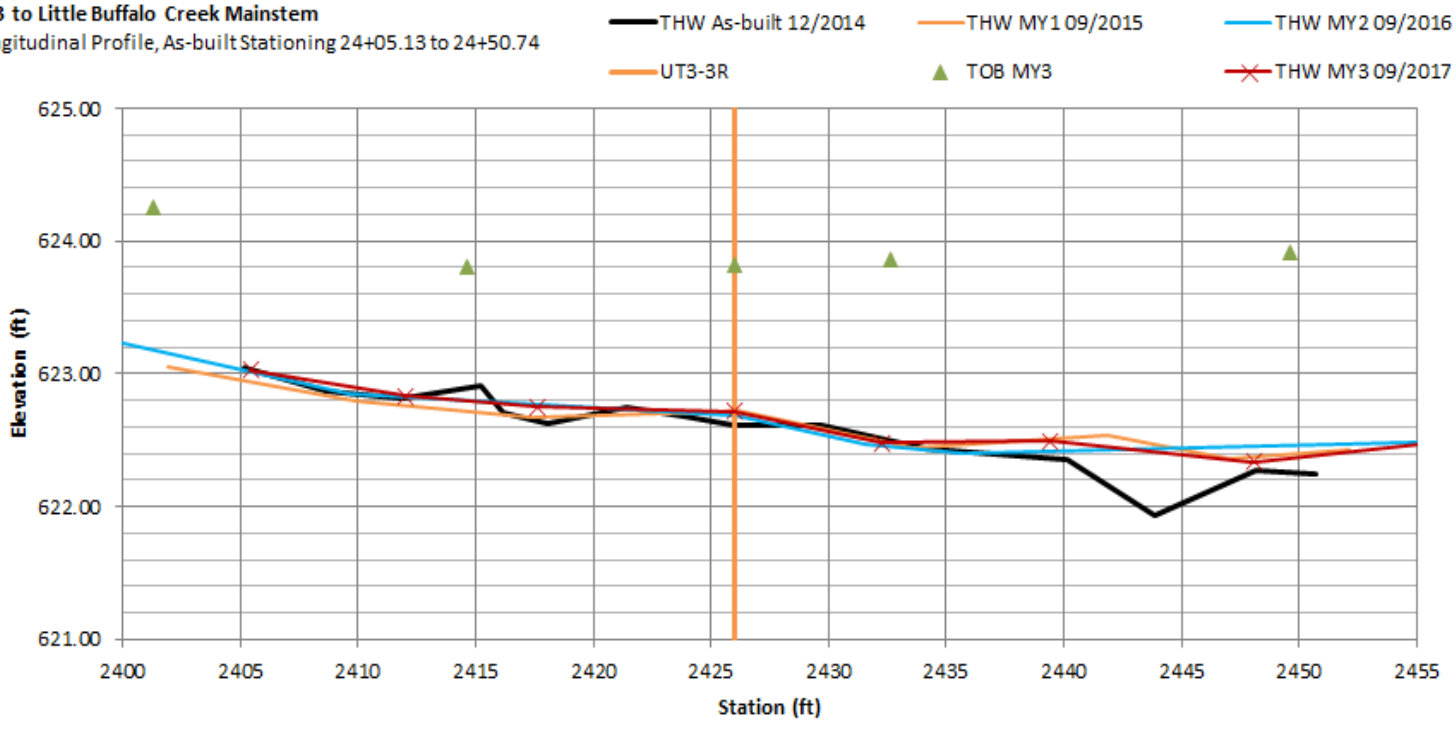

UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 10+00 to 12+15.05
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT3-1R
TOB MY3
THW MY3 09/2017
651.00
650.00
649.00
648.00
647.00
646.00
645.00
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)


UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 14+66.62 to 20+90.79
Extended to 20+90.79
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
THW MY3 09/2017
UT3-1P
UT3-2R
TOB MY3
642.00
640.00
638.00
636.00
634.00
632.00
630.00
628.00
Elevation (ft)
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000
2050
2100
Station (ft)

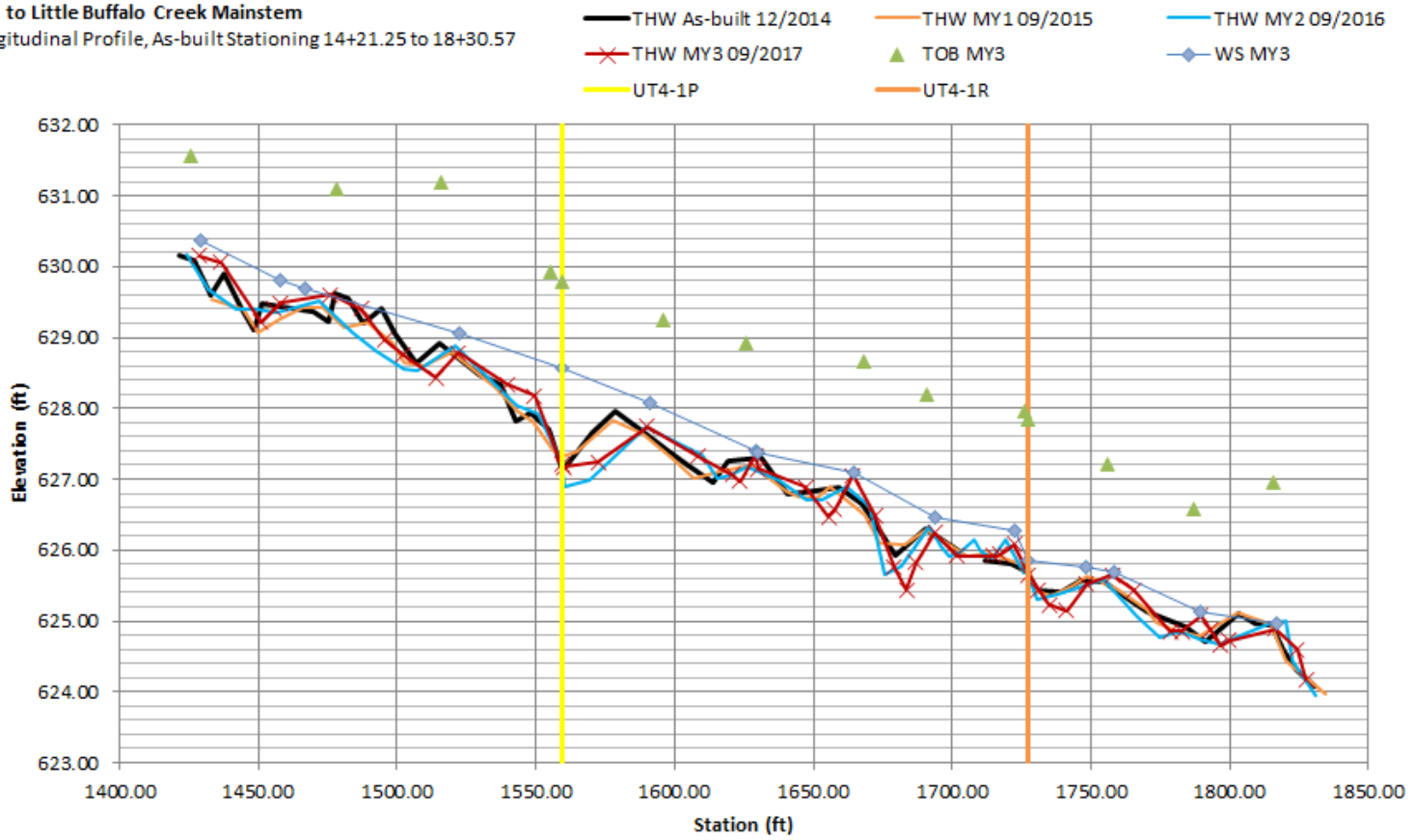
UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 21+29 to 22+32.49;
Extended to Station 22+32.49



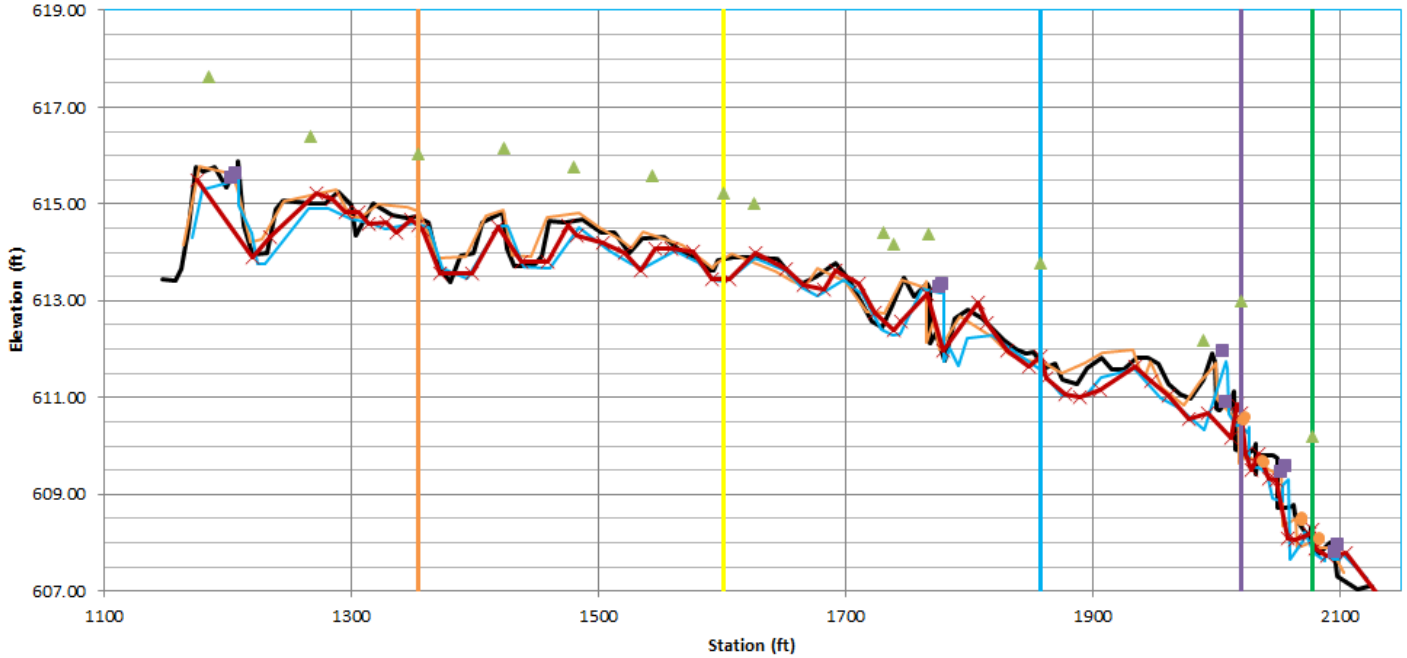
UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 24+05.13 to 24+50.74

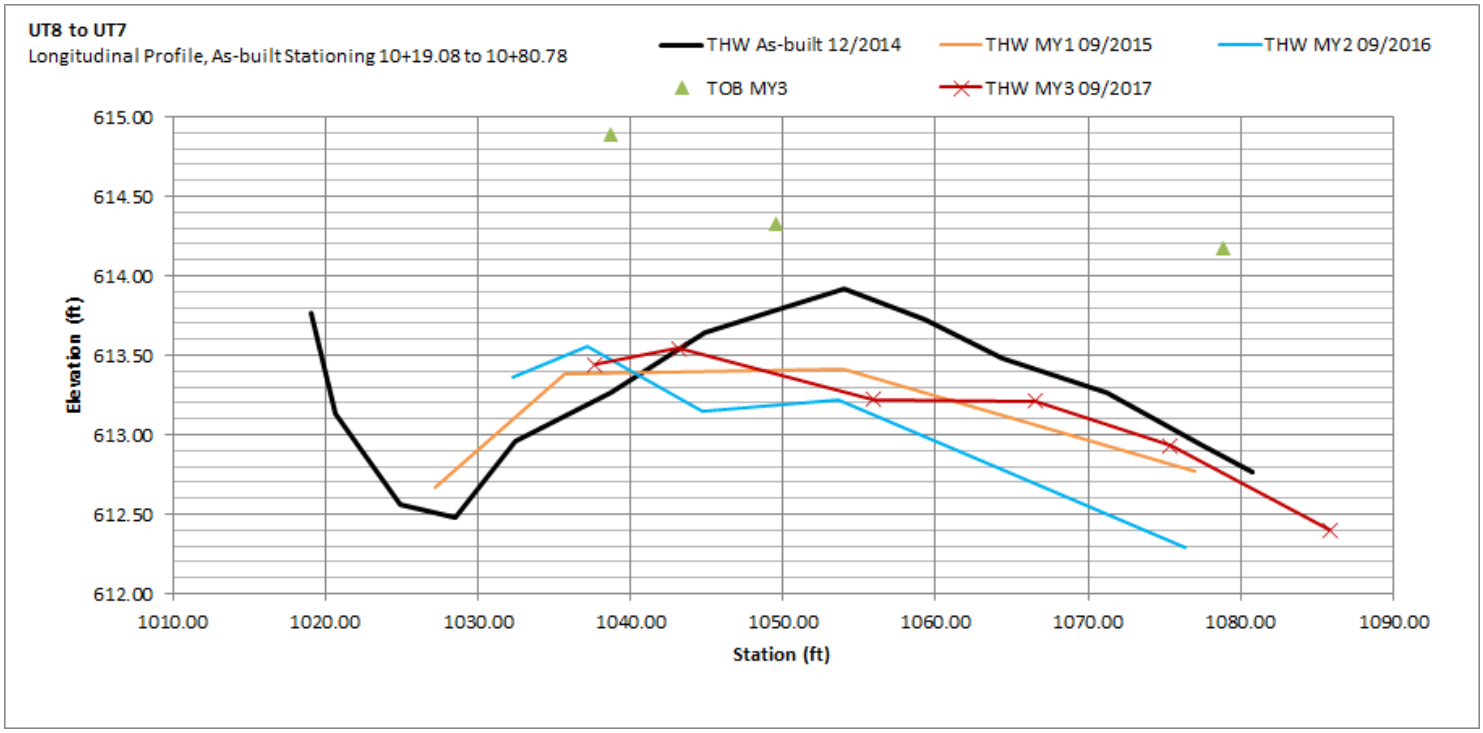


UT4 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 14+21.25 to 18+30.57



UT7 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 11+46.80 to 21+26.71




UT8 to UT7
Longitudinal Profile, As-built Stationing 10+19.08 to 10+80.78
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
TOB MY3
THW MY3 09/2017
615.00
614.50
614.00
613.50
613.00
612.50
612.00
Elevation (ft)
1010.00
1020.00
1030.00
1040.00
1050.00
1060.00
1070.00
1080.00
1090.00
Station (ft)

Figures 4a-q – Cross-section Plot Exhibits

Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-1P
Drainage Area (sq mi):	2.99
Date:	9/27/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	640.37
10.89	639.32
12.97	638.43
18.05	637.99
24.52	638.16
27.77	639.39
37.81	639.87
53.63	640.37

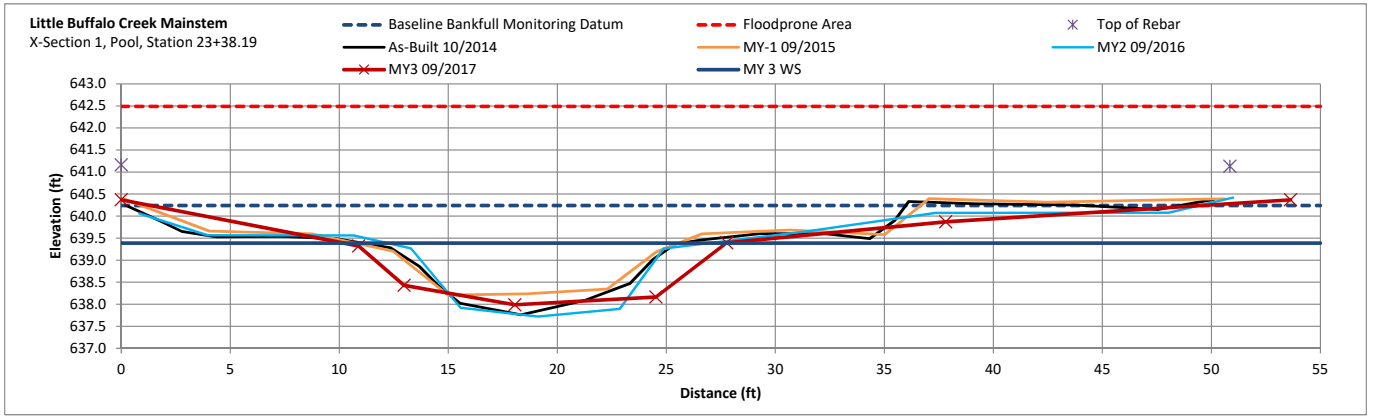
Note: Beaver Dam located downstream of MS-1P inMY3 survey

SUMMARY DATA	
Bankfull Elevation:	640.24
Bankfull Cross-Sectional Area:	43.05
Bankfull Width:	37.81
Flood Prone Area Elevation:	642.49
Flood Prone Width:	>100
Max Depth at Bankfull:	2.25
Mean Depth at Bankful:	1.14
W/D Ratio:	33.21
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.76

Stream Type	C4

Station and description	23+38.19 MS-1P Looking Upstream

23+38.19 MS-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-1R
Drainage Area (sq mi):	2.99
Date:	9/27/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	640.34
5.97	639.25
11.51	638.71
13.17	637.95
18.32	637.96
22.44	638.17
24.67	639.22
34.82	639.42
38.49	640.14

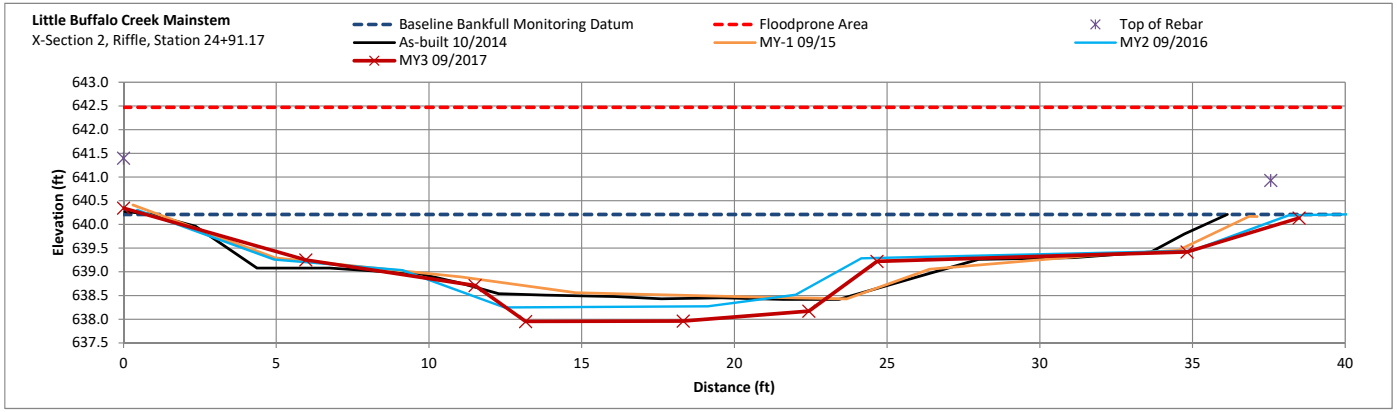
SUMMARY DATA	
Bankfull Elevation:	640.21
Bankfull Cross-Sectional Area:	47.22
Bankfull Width:	38.49
Flood Prone Area Elevation:	642.47
Flood Prone Width:	>100
Max Depth at Bankfull:	2.26
Mean Depth at Bankful:	1.23
W/D Ratio:	31.37
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.42

Stream Type	C4

Note: Beaver Dam located upstream of MS-1R in MY3 survey - no flowing water for cross section

Station and description	24+91.17 MS-1R Looking Upstream

24+91.17 MS-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-2R
Drainage Area (sq mi):	2.82
Date:	9/27/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

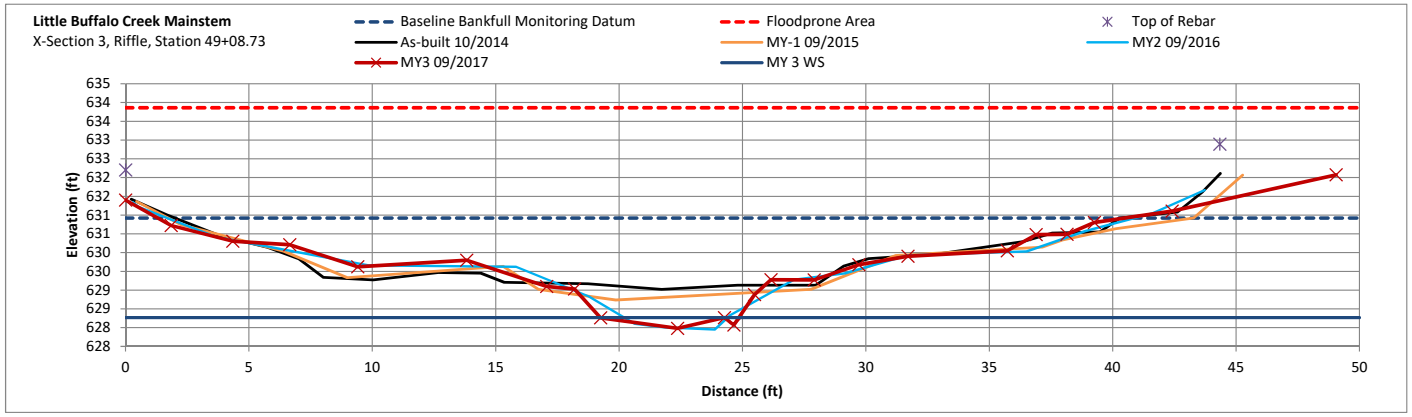
Station	Elevation
0.00	631.40
1.85	630.72
4.34	630.30
6.65	630.21
9.41	629.62
13.82	629.80
17.07	629.10
18.20	629.03
19.25	628.26
22.37	627.98
24.27	628.27
24.65	628.07
25.49	628.88
26.15	629.28
27.90	629.27
29.71	629.68
31.70	629.90
35.73	630.05
36.90	630.48
38.15	630.49
39.26	630.81
42.41	631.11
49.05	632.07

SUMMARY DATA	
Bankfull Elevation:	630.92
Bankfull Cross-Sectional Area:	51.64
Bankfull Width:	37.41
Flood Prone Area Elevation:	633.86
Flood Prone Width:	>100
Max Depth at Bankfull:	2.94
Mean Depth at Bankful:	1.38
W/D Ratio:	27.10
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.44

Stream Type	C4

Station and description	4908.73 MS-2R Looking Upstream

4908.73 MS-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-2P
Drainage Area (sq mi):	2.82
Date:	9/27/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

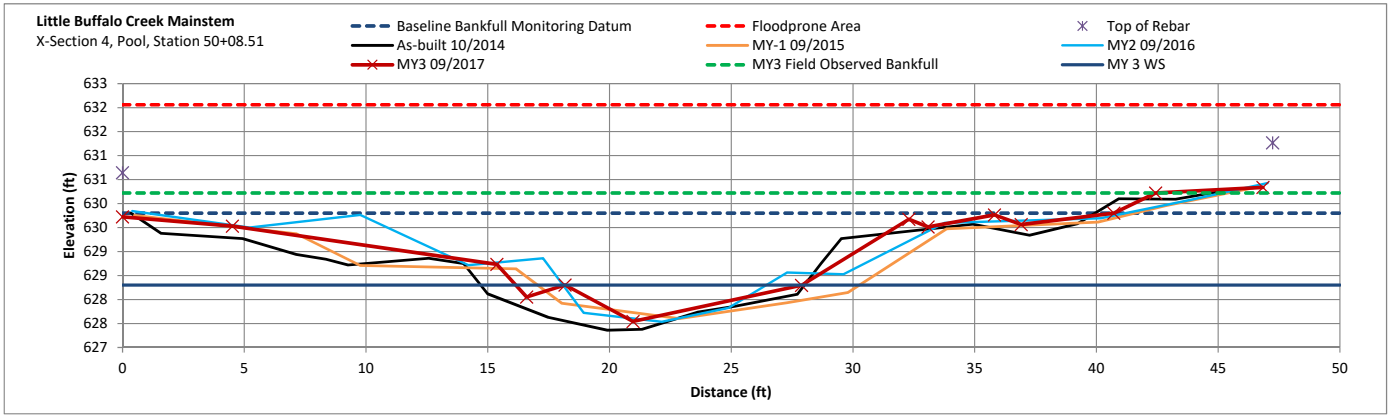
Station	Elevation
0.00	629.72
4.51	629.53
15.38	628.73
16.60	628.05
18.17	628.30
20.97	627.54
27.89	628.30
32.29	629.68
33.08	629.52
35.81	629.76
36.91	629.56
40.71	629.80
42.43	630.22
46.84	630.34

SUMMARY DATA	
Bankfull Elevation:	629.80
Bankfull Cross-Sectional Area:	34.92
Bankfull Width:	37.91
Flood Prone Area Elevation:	632.06
Flood Prone Width:	99.57
Max Depth at Bankfull:	2.26
Mean Depth at Bankful:	0.92
W/D Ratio:	41.16
Entrenchment Ratio:	2.63
Bank Height Ratio:	0.82

Stream Type	C4

Station and description	5008.51 MS-2P Looking Upstream

5008.51 MS-2P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-3P
Drainage Area (sq mi):	4.01
Date:	9/25/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

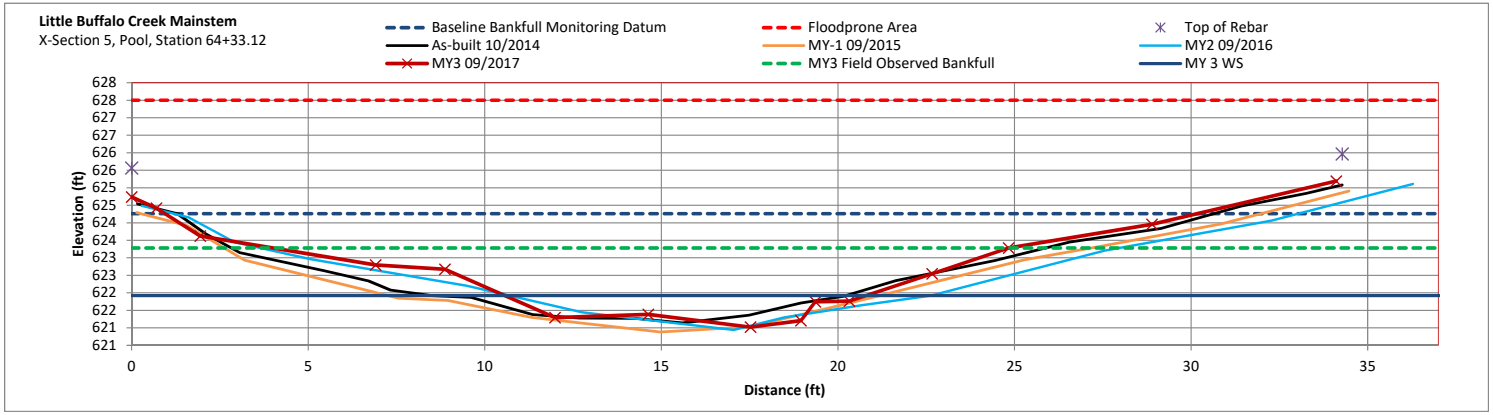
Station	Elevation
0.00	624.74
0.70	624.42
1.94	623.62
6.91	622.80
8.87	622.67
11.99	621.29
14.63	621.39
17.52	621.02
18.95	621.21
19.36	621.74
20.33	621.77
22.67	622.54
24.83	623.28
28.89	623.96
34.11	625.19

SUMMARY DATA	
Bankfull Elevation:	624.26
Bankfull Cross-Sectional Area:	50.77
Bankfull Width:	22.88
Flood Prone Area Elevation:	627.50
Flood Prone Width:	>100
Max Depth at Bankfull:	3.24
Mean Depth at Bankful:	2.22
W/D Ratio:	10.32
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.72

Stream Type	C4

Station and description	6433.12 MS-3P Looking Upstream

6433.12 MS-3P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT2-1R
Drainage Area (sq mi):	0.3
Date:	9/27/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

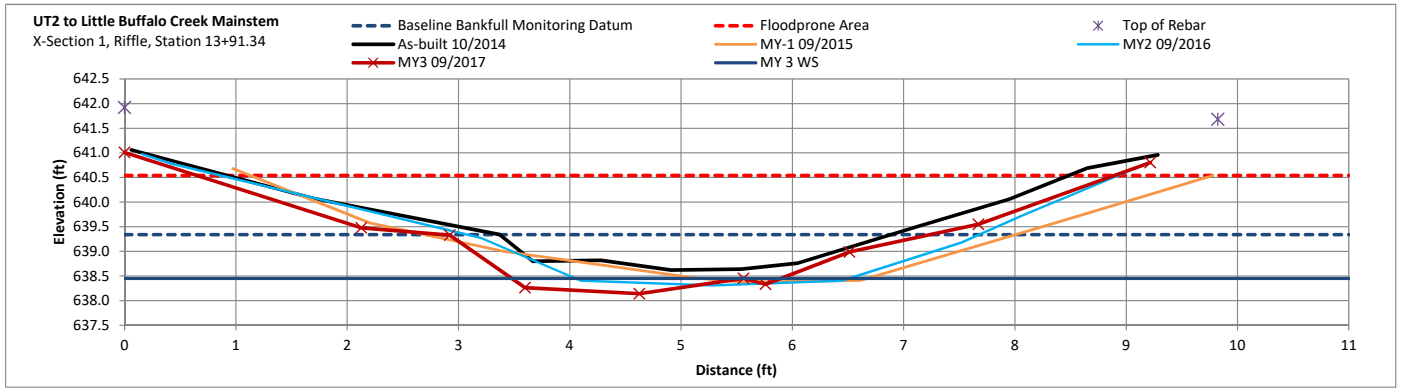
Station	Elevation
0.00	641.01
2.13	639.48
2.92	639.33
3.60	638.26
4.63	638.14
5.56	638.45
5.76	638.33
6.51	638.99
7.67	639.55
9.22	640.81

SUMMARY DATA	
Bankfull Elevation:	639.34
Bankfull Cross-Sectional Area:	3.22
Bankfull Width:	3.59
Flood Prone Area Elevation:	640.54
Flood Prone Width:	10.96
Max Depth at Bankfull:	1.20
Mean Depth at Bankful:	0.90
W/D Ratio:	4.00
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.18

Stream Type	B4c

Station and description	1391.34 UT2-1R Looking Upstream

1391.34 UT2-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-1R
Drainage Area (sq mi):	0.097
Date:	9/24/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	647.83
0.74	647.37
2.47	647.24
3.37	646.65
4.42	646.54
4.93	646.50
5.47	646.89
7.13	647.39
8.71	647.93

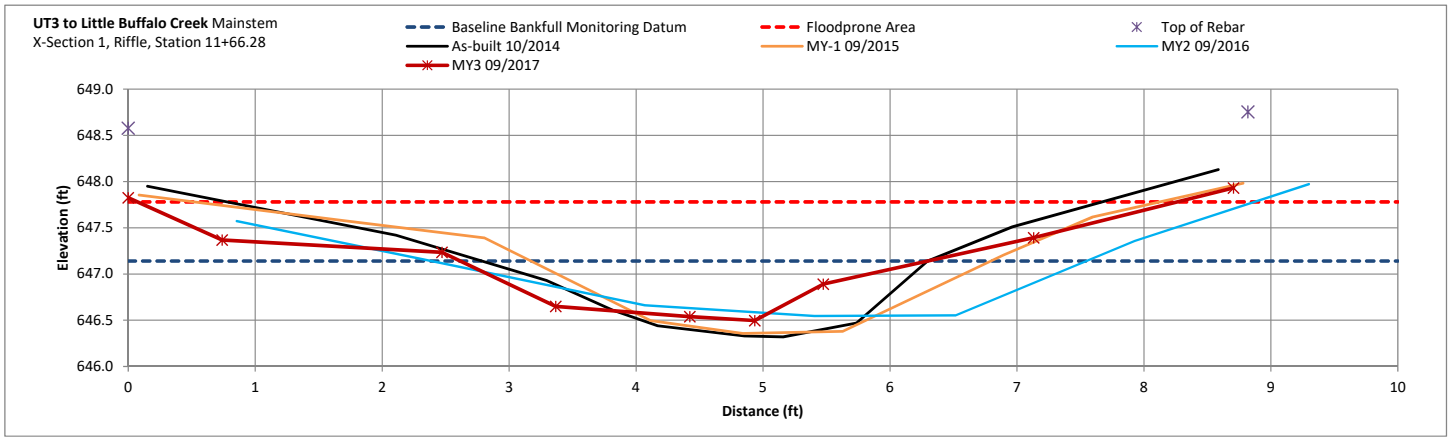
Note: No visual water surface during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	647.14
Bankfull Cross-Sectional Area:	1.36
Bankfull Width:	4.66
Flood Prone Area Elevation:	647.78
Flood Prone Width:	11.22
Max Depth at Bankfull:	0.64
Mean Depth at Bankful:	0.29
W/D Ratio:	16.01
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.90

Stream Type	B6

Station and description	1166.28 UT3-1R Looking Upstream

1166.28 UT3-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-1P
Drainage Area (sq mi):	0.097
Date:	9/25/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	640.86
1.12	640.18
2.31	639.65
3.42	639.41
4.18	639.05
6.15	638.92
6.57	638.80
7.26	638.71
9.83	638.93
10.33	639.34
11.79	639.74
12.70	640.17

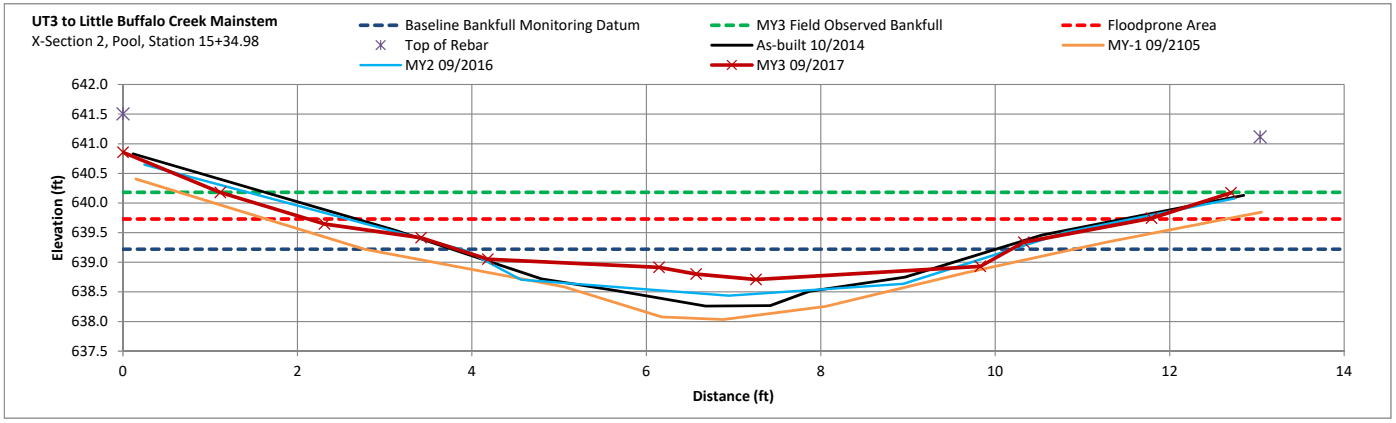
SUMMARY DATA	
Bankfull Elevation:	639.22
Bankfull Cross-Sectional Area:	2.03
Bankfull Width:	9.21
Flood Prone Area Elevation:	639.73
Flood Prone Width:	9.41
Max Depth at Bankfull:	0.51
Mean Depth at Bankful:	0.22
W/D Ratio:	41.78
Entrenchment Ratio:	1.02
Bank Height Ratio:	0.53

Stream Type	B6

Station and description	1534.98 UT3-1P Looking Upstream

1534.98 UT3-1P Looking Downstream

Note: No visual water surface during MY 3 survey



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-2R
Drainage Area (sq mi):	0.097
Date:	9/25/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	634.58
1.03	633.97
4.32	632.74
6.73	632.65
10.41	632.92
14.49	634.26
17.48	635.41

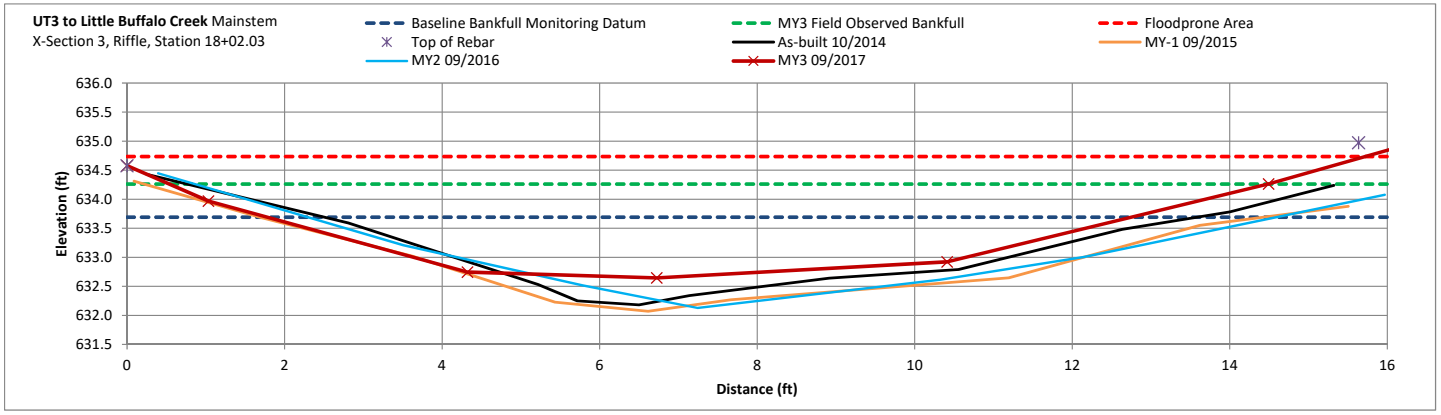
Note: No visual water surface during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	633.69
Bankfull Cross-Sectional Area:	7.29
Bankfull Width:	13.46
Flood Prone Area Elevation:	634.74
Flood Prone Width:	15.96
Max Depth at Bankfull:	1.05
Mean Depth at Bankful:	0.54
W/D Ratio:	24.84
Entrenchment Ratio:	1.19
Bank Height Ratio:	0.82

Stream Type	B6

Station and description	1802.03 UT3-2R Looking Upstream

1802.03 UT3-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-3R
Drainage Area (sq mi):	0.097
Date:	9/25/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	624.86
0.20	623.95
2.16	623.06
3.52	622.81
4.09	622.72
4.74	622.80
6.85	623.58
7.40	623.82
9.05	624.05

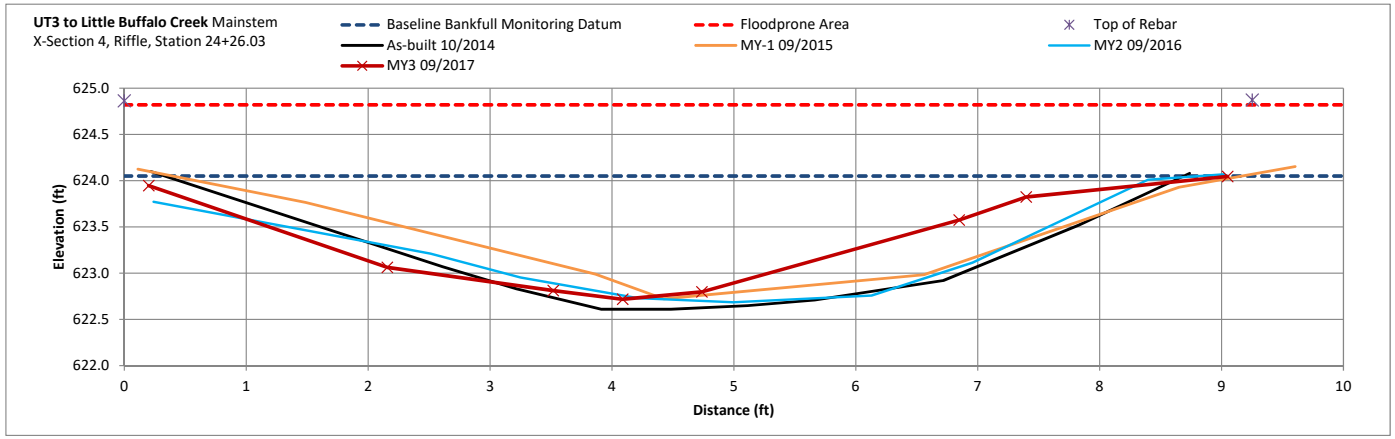
Note: No visual water surface during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	623.77
Bankfull Cross-Sectional Area:	4.29
Bankfull Width:	8.85
Flood Prone Area Elevation:	624.82
Flood Prone Width:	90.60
Max Depth at Bankfull:	1.05
Mean Depth at Bankful:	0.48
W/D Ratio:	18.27
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.17

Stream Type	B6

Station and description	2426.03 UT3-3R Looking Upstream

2426.03 UT3-3R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT4-1P
Drainage Area (sq mi):	0.4
Date:	9/26/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

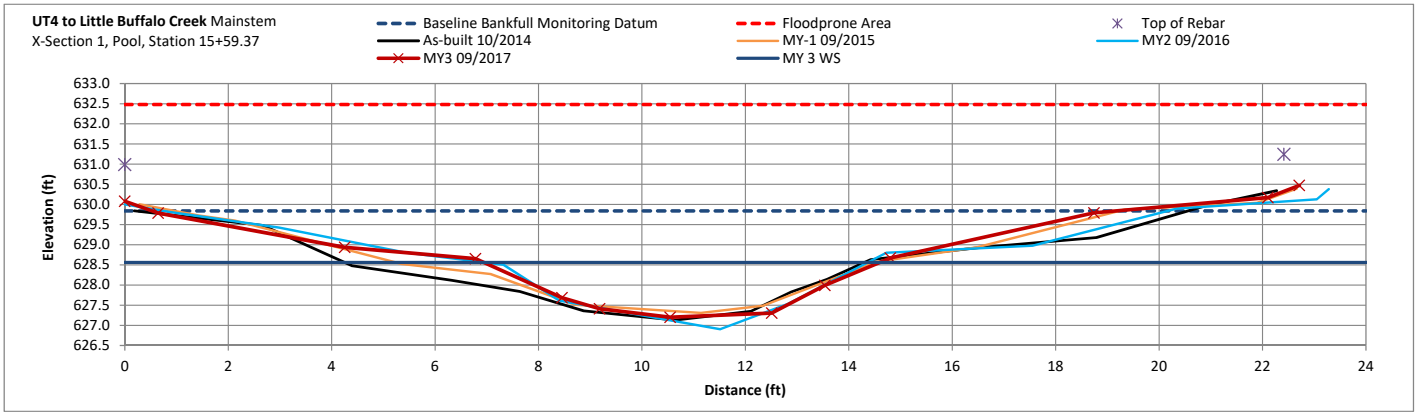
Station	Elevation
0.00	630.08
0.65	629.79
4.25	628.94
6.78	628.66
8.45	627.69
9.18	627.41
10.55	627.20
12.51	627.31
13.54	627.99
14.80	628.67
18.74	629.79
22.10	630.17
22.71	630.47

SUMMARY DATA	
Bankfull Elevation:	629.84
Bankfull Cross-Sectional Area:	23.94
Bankfull Width:	18.10
Flood Prone Area Elevation:	632.48
Flood Prone Width:	77.83
Max Depth at Bankfull:	2.64
Mean Depth at Bankful:	1.32
W/D Ratio:	18.10
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.95

Stream Type	C4

Station and description	1559.37 UT4-1P Looking Upstream

1559.37 UT4-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT4-1R
Drainage Area (sq mi):	0.4
Date:	9/26/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

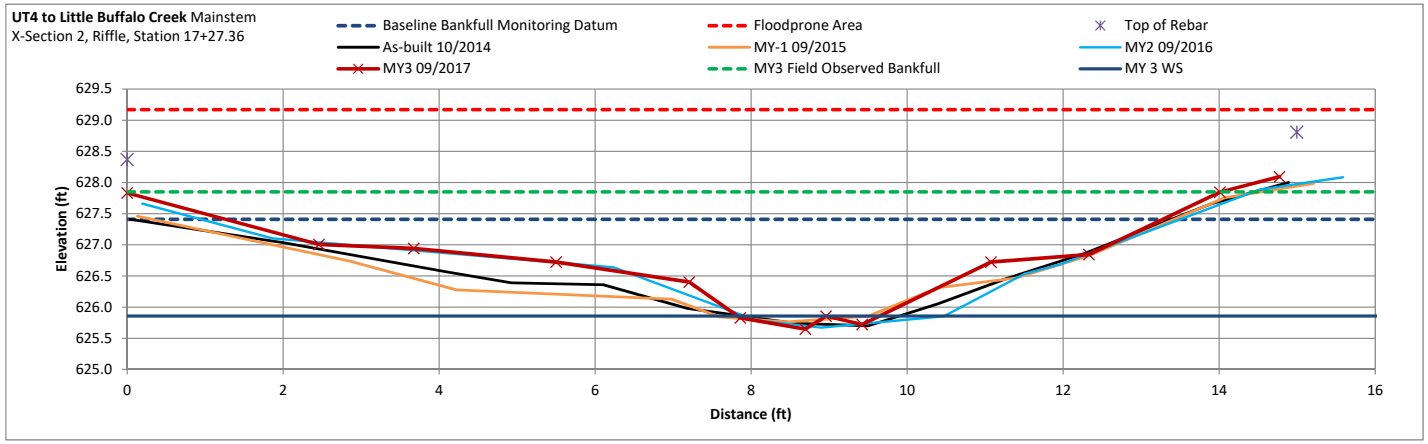
Station	Elevation
0.00	627.83
2.46	627.01
3.67	626.94
5.50	626.73
7.21	626.40
7.86	625.83
8.69	625.65
8.96	625.86
9.42	625.72
11.07	626.72
12.33	626.85
14.01	627.85
14.77	628.09

SUMMARY DATA	
Bankfull Elevation:	627.41
Bankfull Cross-Sectional Area:	9.70
Bankfull Width:	11.55
Flood Prone Area Elevation:	629.17
Flood Prone Width:	35.53
Max Depth at Bankfull:	1.76
Mean Depth at Bankful:	0.84
W/D Ratio:	13.75
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.80

Stream Type	C4

Station and description	1727.36 UT4-1R Looking Upstream

1727.36 UT4-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-1R
Drainage Area (sq mi):	1.91
Date:	9/23/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	616.47
0.53	616.45
3.20	616.43
7.02	616.02
9.53	614.85
13.04	615.22
16.54	614.83
19.01	614.71
22.32	614.56
24.63	614.70
25.80	615.31
26.51	615.37
28.16	616.03
29.46	616.21
32.68	616.22
37.09	616.62

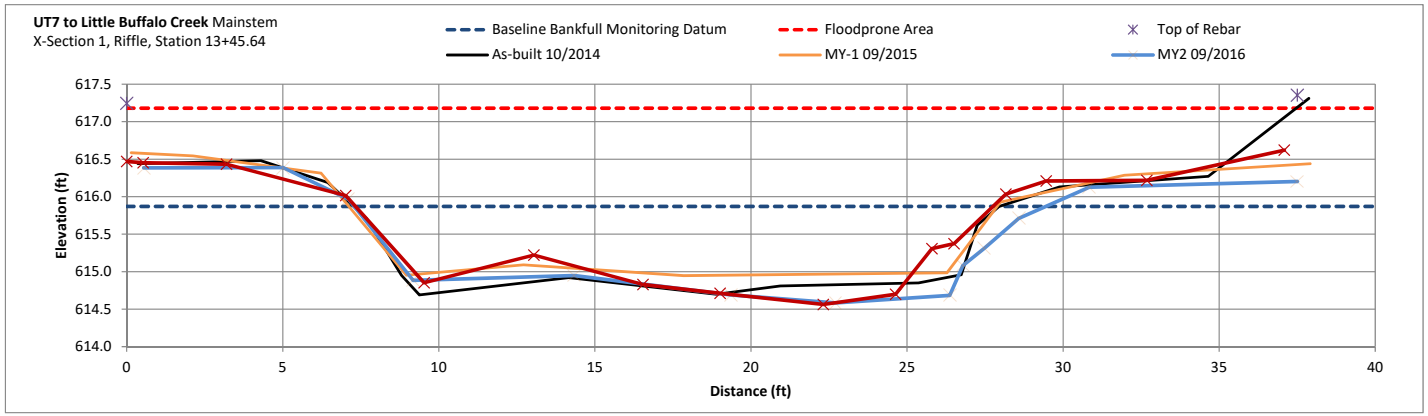
Note: UT 7 was dry during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	615.87
Bankfull Cross-Sectional Area:	18.21
Bankfull Width:	21.15
Flood Prone Area Elevation:	617.18
Flood Prone Width:	>100
Max Depth at Bankfull:	1.31
Mean Depth at Bankful:	0.86
W/D Ratio:	24.56
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.24

Stream Type	C4

Station and description	1345.64 UT7-1R Looking Upstream

1345.64 UT7-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-1P
Drainage Area (sq mi):	1.91
Date:	9/23/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	615.32
3.19	614.94
7.41	614.65
10.01	613.89
12.95	613.65
17.83	613.41
22.46	613.32
26.53	613.94
30.06	615.22
36.34	615.38
41.66	615.60

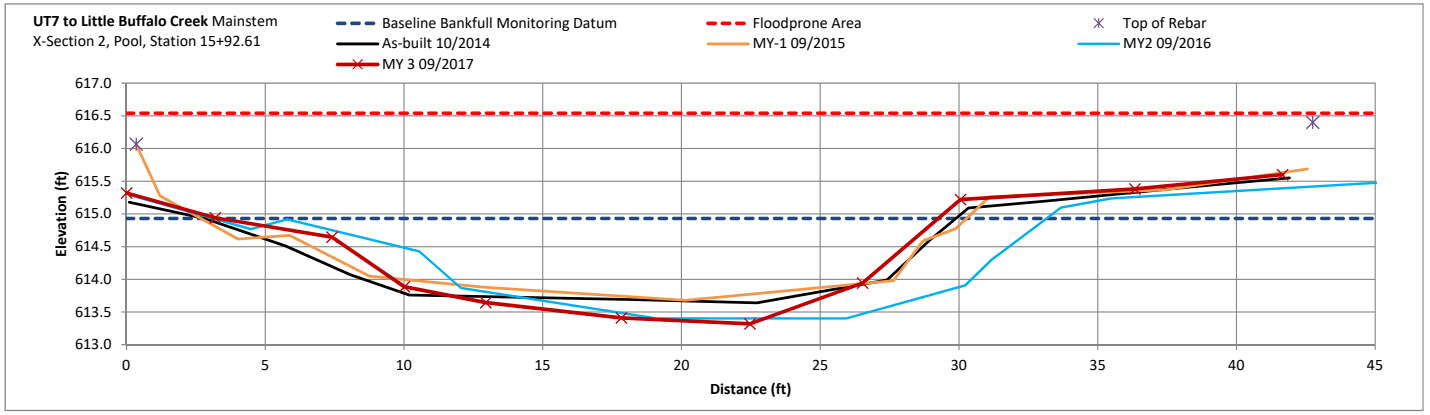
Note: UT 7 was dry during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	614.93
Bankfull Cross-Sectional Area:	25.11
Bankfull Width:	22.65
Flood Prone Area Elevation:	616.54
Flood Prone Width:	>100
Max Depth at Bankfull:	1.61
Mean Depth at Bankful:	1.11
W/D Ratio:	20.43
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.03

Stream Type	C4

Station and description	1592.61 UT7-1P Looking Upstream

1592.61 UT7-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-2R
Drainage Area (sq mi):	1.91
Date:	9/24/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	613.81
2.40	613.82
4.14	613.46
5.73	612.88
7.26	611.84
8.55	611.82
11.02	611.86
13.18	611.86
15.30	612.52
17.70	612.62
20.28	612.70
22.37	613.77
24.16	614.01
26.80	614.05

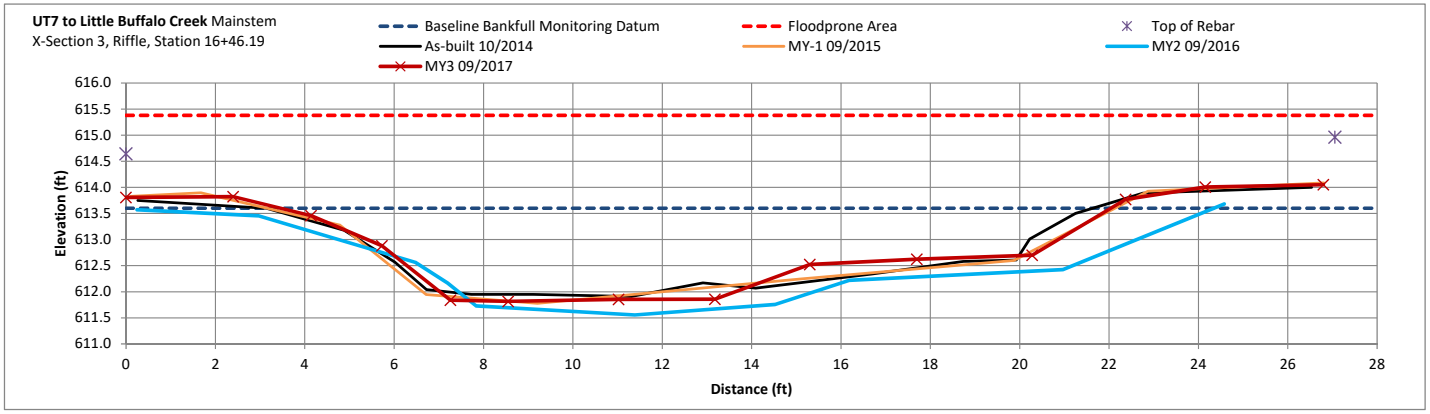
Note: UT 7 was dry during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	613.60
Bankfull Cross-Sectional Area:	21.00
Bankfull Width:	18.23
Flood Prone Area Elevation:	615.38
Flood Prone Width:	>100
Max Depth at Bankfull:	1.78
Mean Depth at Bankful:	1.15
W/D Ratio:	15.83
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.97

Stream Type	C4

Station and description	1846.19 UT7-2R Looking Upstream

1846.19 UT7-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-STP1
Drainage Area (sq mi):	1.91
Date:	9/24/2017
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	614.17
5.26	614.21
11.12	613.42
14.92	612.91
18.68	611.04
24.84	610.77
30.16	610.68
33.25	610.55
36.35	610.73
38.09	611.64
39.27	611.99
41.44	612.98
49.09	613.87
57.25	614.22

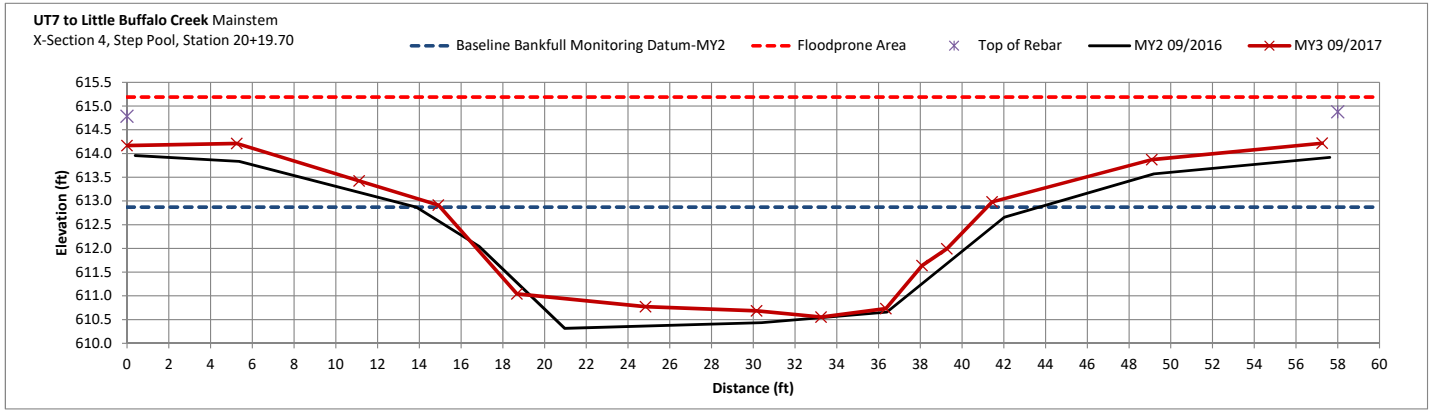
Note: UT 7 was dry during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	612.87
Bankfull Cross-Sectional Area:	44.98
Bankfull Width:	26.53
Flood Prone Area Elevation:	615.19
Flood Prone Width:	>100
Max Depth at Bankfull:	2.32
Mean Depth at Bankful:	1.70
W/D Ratio:	15.65
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.92

Stream Type	C4b

Station and description	2019.70 UT7-STP1 Looking Upstream

2019.70 UT7-STP1 Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-STP2
Drainage Area (sq mi):	1.91
Date:	9/24/2016
Field Crew:	Matthew Holthaus, Shaddi Kamel: Louis Berger

Station	Elevation
0.00	611.82
2.98	611.35
6.32	610.72
11.03	609.98
14.23	609.34
16.56	609.23
18.38	608.99
20.49	608.23
23.27	608.18
28.52	608.45
29.71	608.76
32.04	609.27
33.85	610.20
39.85	611.59
47.35	612.83
52.76	613.53

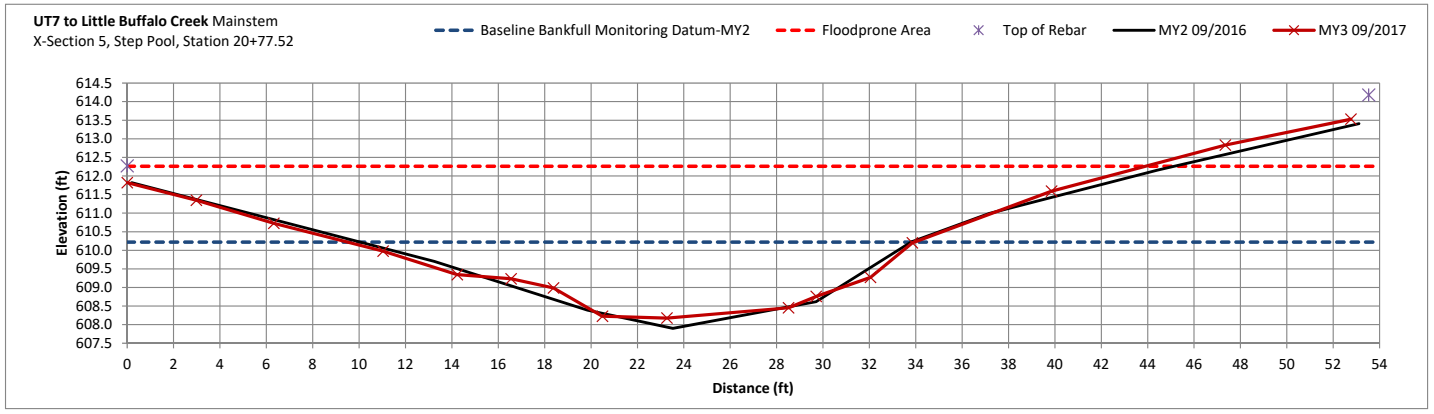
Note: UT 7 was dry during MY 3 survey

SUMMARY DATA	
Bankfull Elevation:	610.22
Bankfull Cross-Sectional Area:	31.17
Bankfull Width:	22.82
Flood Prone Area Elevation:	612.26
Flood Prone Width:	38.67
Max Depth at Bankfull:	2.04
Mean Depth at Bankful:	1.37
W/D Ratio:	16.71
Entrenchment Ratio:	1.69
Bank Height Ratio:	0.78

Stream Type	B4

Station and description	2077.52 UT7-STP2 Looking Upstream

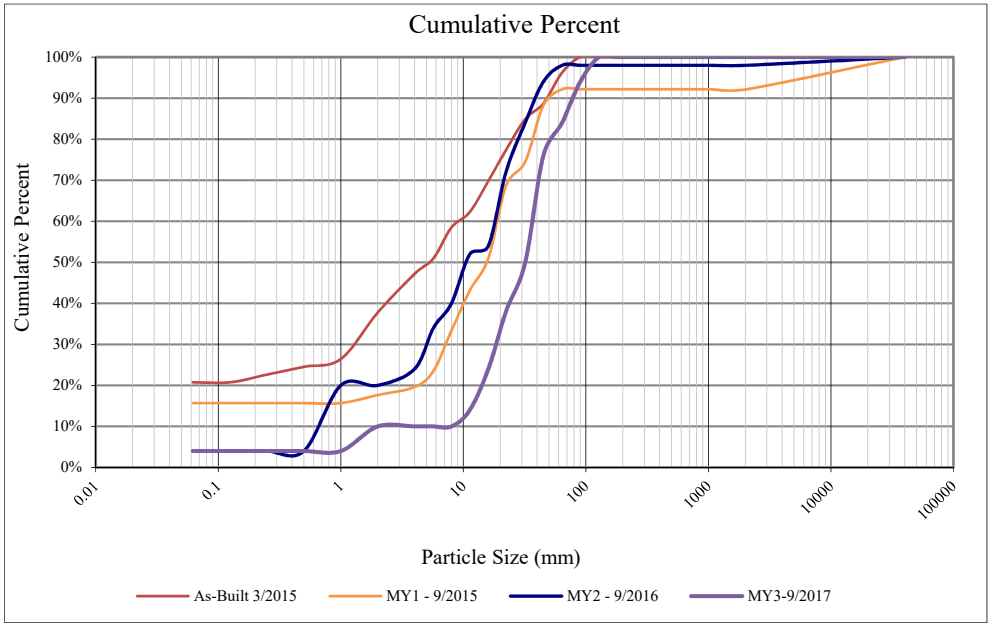
2077.52 UT7-STP2 Looking Downstream

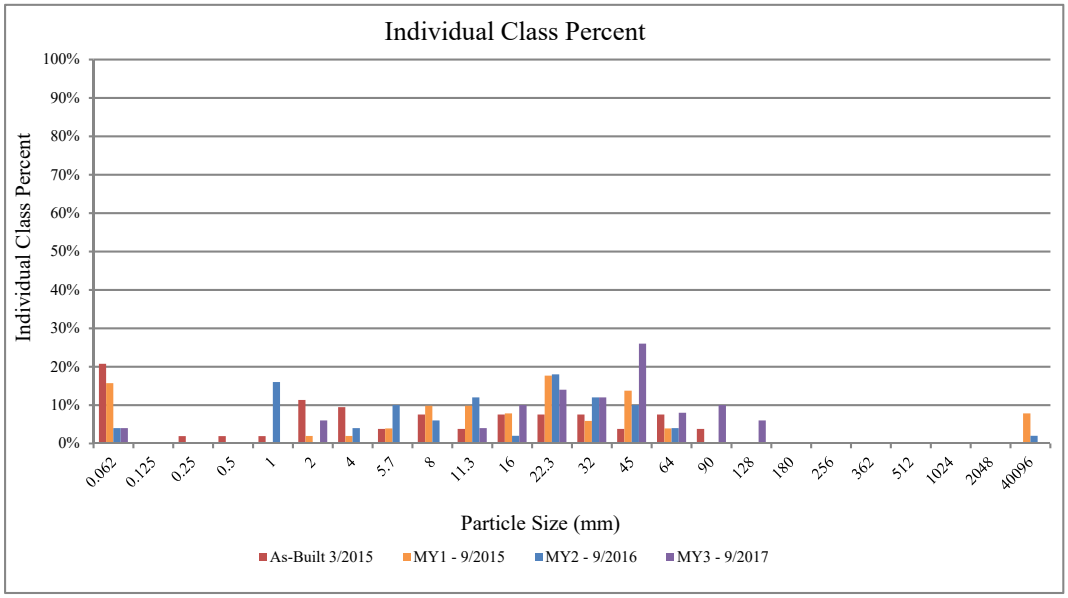


Figures 5a-q – Pebble Count Plots

Project Name: Little Buffalo Creek					
Cross-Section: MS-1P					
Feature: Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	0	0%	4%
	very coarse sand	2.0	3	6%	10%
Gravel	very fine gravel	4.0	0	0%	10%
	fine gravel	5.7	0	0%	10%
	fine gravel	8.0	0	0%	10%
	medium gravel	11.3	2	4%	14%
	medium gravel	16.0	5	10%	24%
	coarse gravel	22.3	7	14%	38%
	coarse gravel	32.0	6	12%	50%
	very coarse gravel	45	13	26%	76%
	very coarse gravel	64	4	8%	84%
Cobble	small cobble	90	5	10%	94%
	medium cobble	128	3	6%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

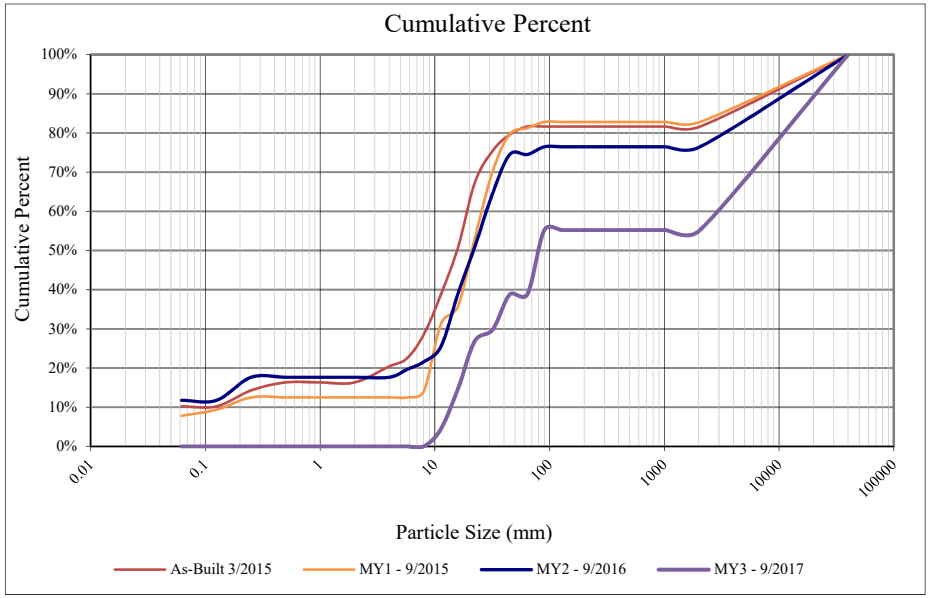
Summary Data	
D16	12.24
D35	20.95
D50	32.00
D84	64.00
D95	96.33
D100	128.00

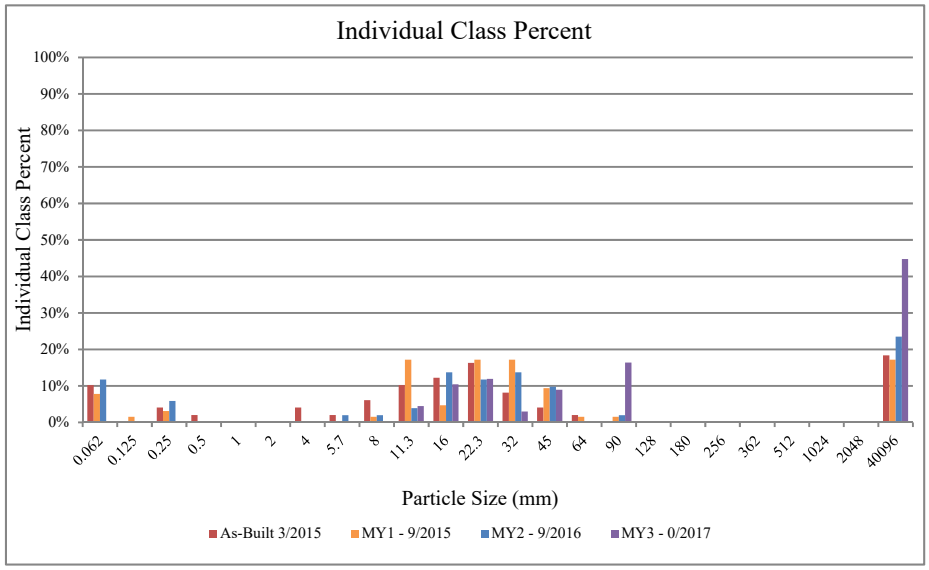




Project Name: Little Buffalo Creek					
Cross-Section: MS-1R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	3	4%	4%
	medium gravel	16.0	7	10%	15%
	coarse gravel	22.3	8	12%	27%
	coarse gravel	32.0	2	3%	30%
	very coarse gravel	45	6	9%	39%
	very coarse gravel	64	0	0%	39%
Cobble	small cobble	90	11	16%	55%
	medium cobble	128	0	0%	55%
	large cobble	180	0	0%	55%
	very large cobble	256	0	0%	55%
Boulder	small boulder	362	0	0%	55%
	small boulder	512	0	0%	55%
	medium boulder	1024	0	0%	55%
	large boulder	2048	0	0%	55%
Bedrock	bedrock	40096	30	45%	100%
TOTAL % of whole count			67	100%	100%

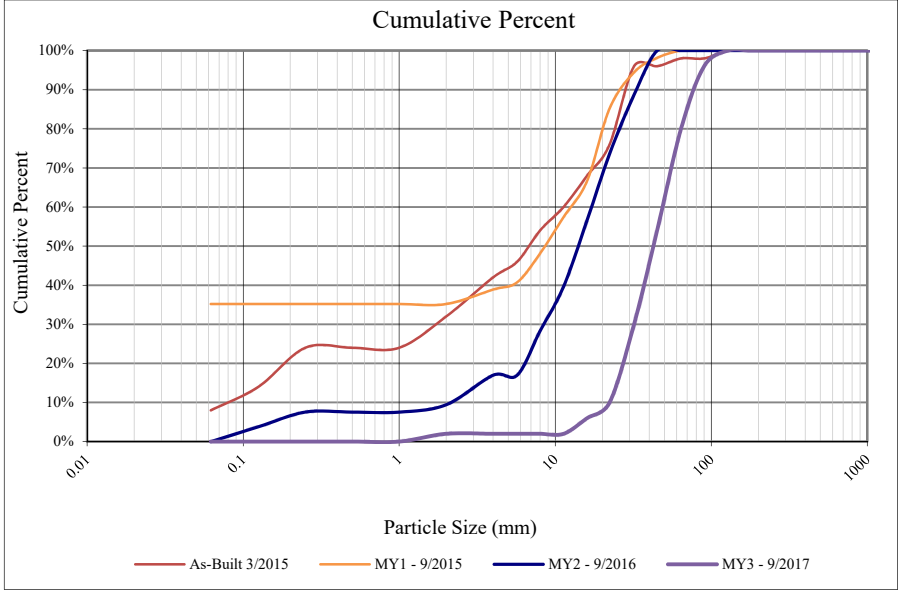
Summary Data	
D16	16.57
D35	39.48
D50	81.73
D84	Bedrock
D95	Bedrock
D100	Bedrock

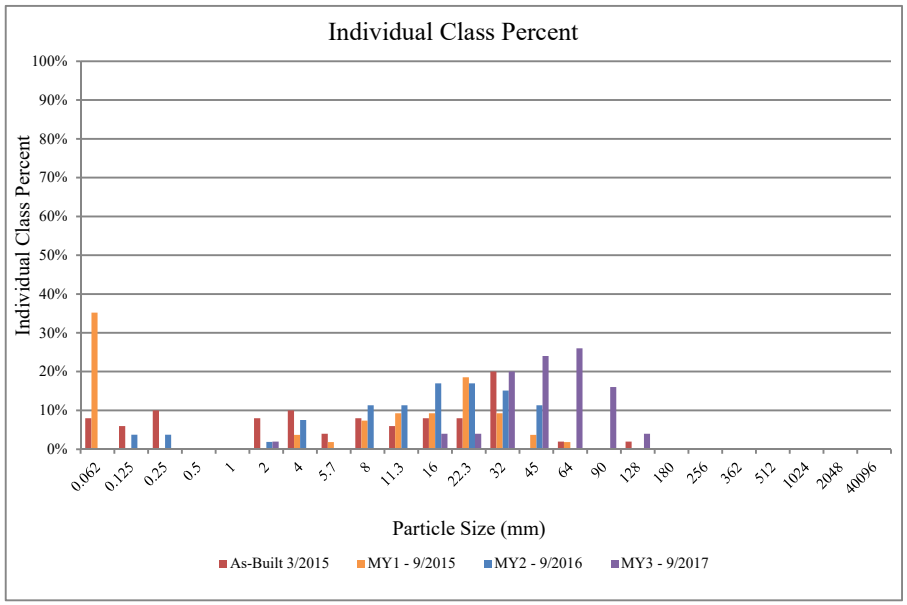




Project Name: Little Buffalo Creek					
Cross-Section: MS-2P					
Feature: Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	1	2%	2%
Gravel	very fine gravel	4.0	0	0%	2%
	fine gravel	5.7	0	0%	2%
	fine gravel	8.0	0	0%	2%
	medium gravel	11.3	0	0%	2%
	medium gravel	16.0	2	4%	6%
	coarse gravel	22.3	2	4%	10%
	coarse gravel	32.0	10	20%	30%
	very coarse gravel	45	12	24%	54%
	very coarse gravel	64	13	26%	80%
Cobble	small cobble	90	8	16%	96%
	medium cobble	128	2	4%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

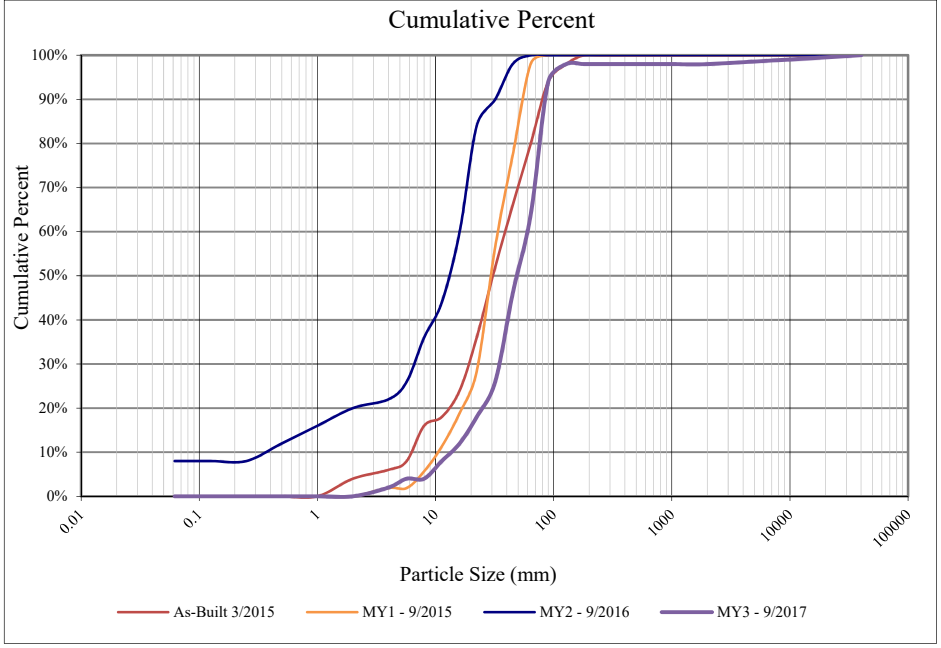
Summary Data	
D16	25.21
D35	34.71
D50	42.83
D84	70.50
D95	88.38
D100	128.00

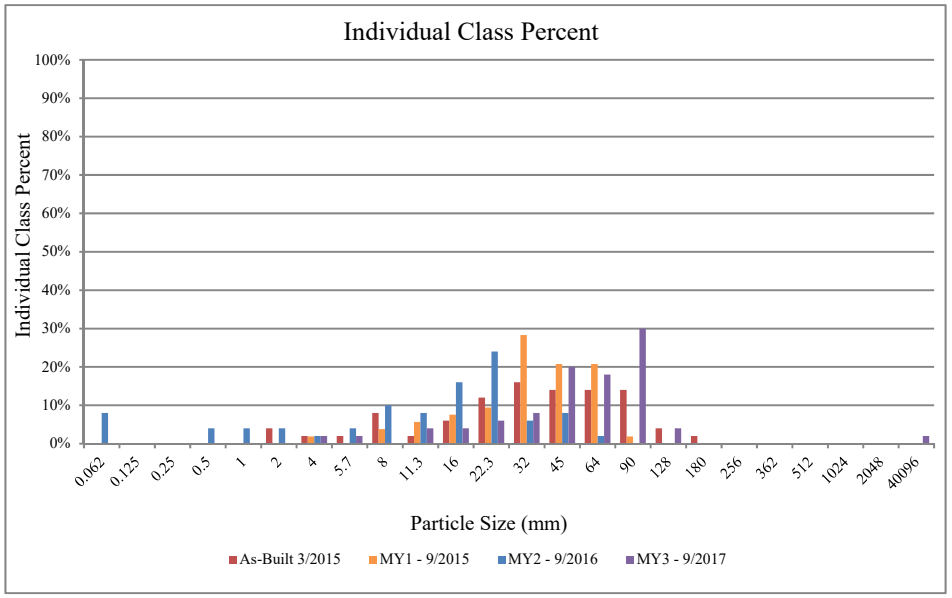




Project Name: Little Buffalo Creek					
Cross-Section: MS-2R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	1	2%	2%
	fine gravel	5.7	1	2%	4%
	fine gravel	8.0	0	0%	4%
	medium gravel	11.3	2	4%	8%
	medium gravel	16.0	2	4%	12%
	coarse gravel	22.3	3	6%	18%
	coarse gravel	32.0	4	8%	26%
	very coarse gravel	45	10	20%	46%
	very coarse gravel	64	9	18%	64%
Cobble	small cobble	90	15	30%	94%
	medium cobble	128	2	4%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulder	1024	0	0%	98%
	large boulder	2048	0	0%	98%
Bedrock	bedrock	40096	1	2%	100%
TOTAL % of whole count			50	100%	100%

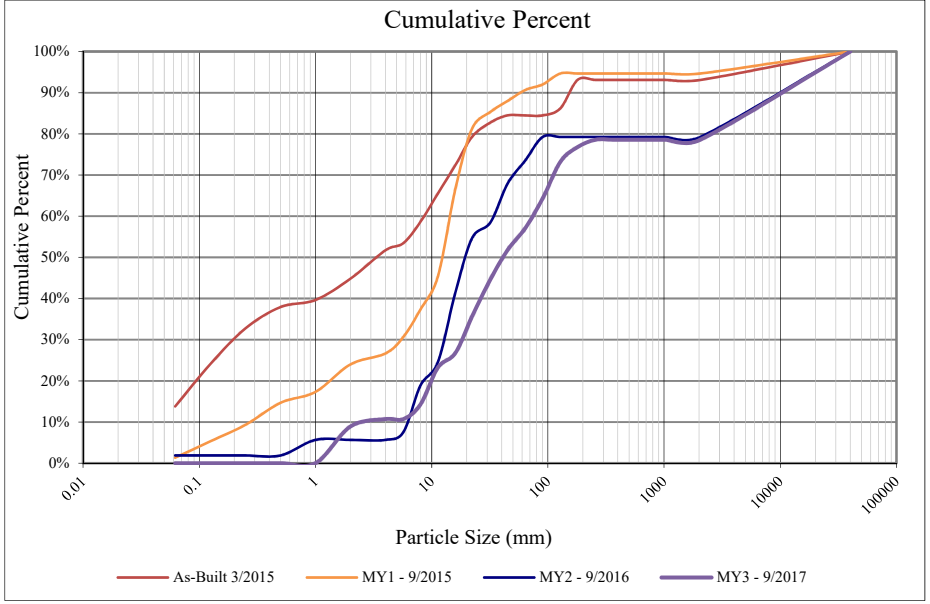
Summary Data	
D16	20.20
D35	37.85
D50	49.22
D84	81.33
D95	99.50
D100	Bedrock

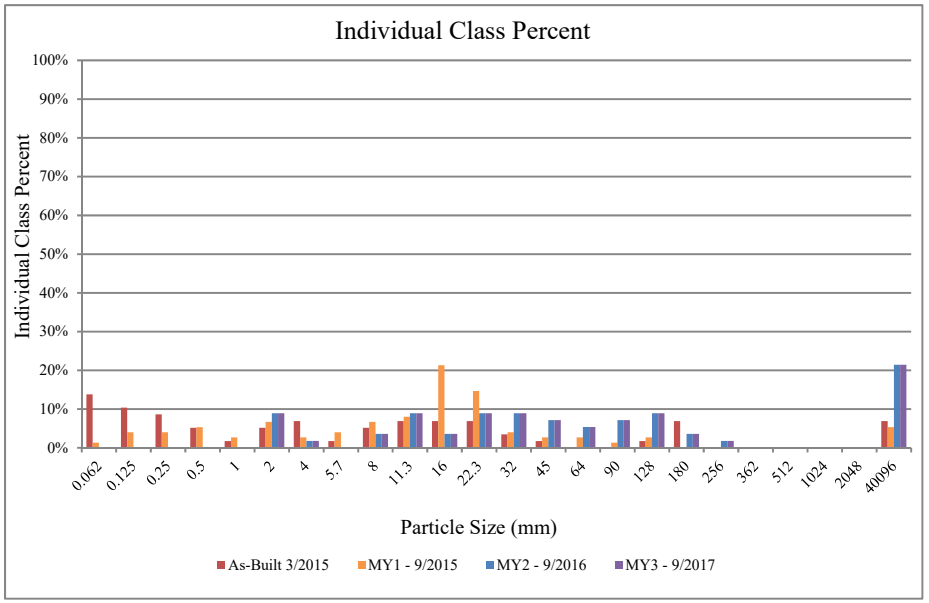




Project Name: Little Buffalo Creek					
Cross-Section: MS-3P					
Feature: Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	5	9%	9%
Gravel	very fine gravel	4.0	1	2%	11%
	fine gravel	5.7	0	0%	11%
	fine gravel	8.0	2	4%	14%
	medium gravel	11.3	5	9%	23%
	medium gravel	16.0	2	4%	27%
	coarse gravel	22.3	5	9%	36%
	coarse gravel	32.0	5	9%	45%
	very coarse gravel	45	4	7%	52%
	very coarse gravel	64	3	5%	57%
Cobble	small cobble	90	4	7%	64%
	medium cobble	128	5	9%	73%
	large cobble	180	2	4%	77%
	very large cobble	256	1	2%	79%
Boulder	small boulder	362	0	0%	79%
	small boulder	512	0	0%	79%
	medium boulder	1024	0	0%	79%
	large boulder	2048	0	0%	79%
Bedrock	bedrock	40096	12	21%	100%
TOTAL % of whole count			56	100%	100%

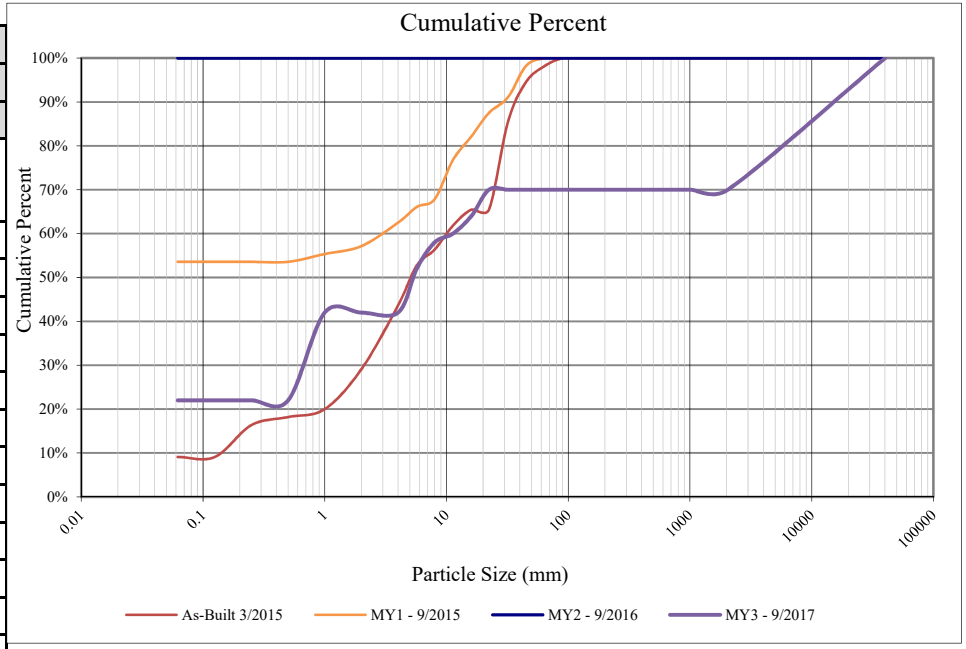
Summary Data	
D16	8.63
D35	21.80
D50	41.75
D84	Bedrock
D95	Bedrock
D100	Bedrock

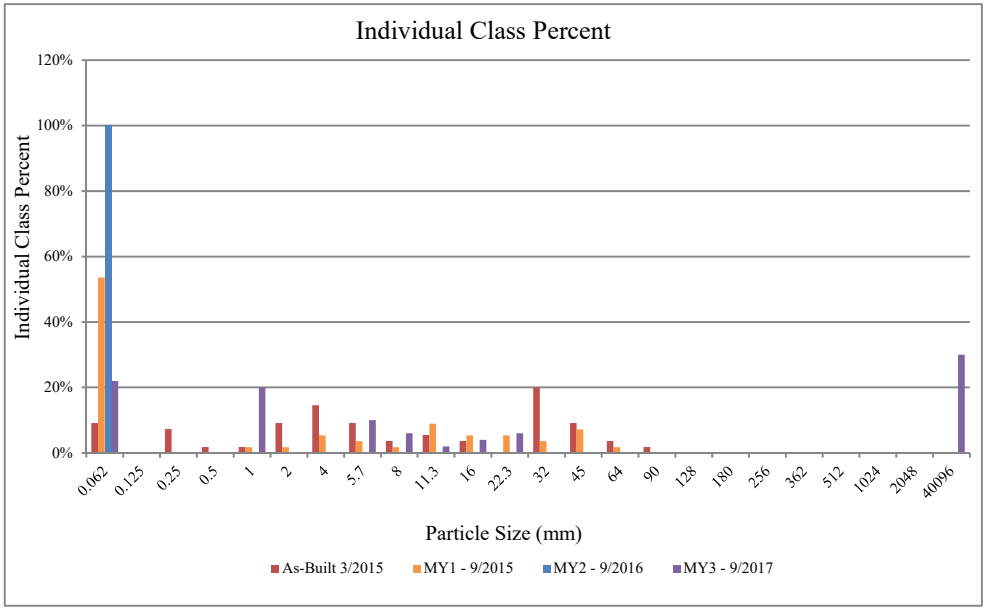




Project Name: Little Buffalo Creek					
Cross-Section: UT2-1R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	11	22%	22%
Sand	very fine sand	0.125	0	0%	22%
	fine sand	0.250	0	0%	22%
	medium sand	0.50	0	0%	22%
	coarse sand	1.00	10	20%	42%
	very coarse sand	2.0	0	0%	42%
Gravel	very fine gravel	4.0	0	0%	42%
	fine gravel	5.7	5	10%	52%
	fine gravel	8.0	3	6%	58%
	medium gravel	11.3	1	2%	60%
	medium gravel	16.0	2	4%	64%
	coarse gravel	22.3	3	6%	70%
	coarse gravel	32.0	0	0%	70%
	very coarse gravel	45	0	0%	70%
	very coarse gravel	64	0	0%	70%
Cobble	small cobble	90	0	0%	70%
	medium cobble	128	0	0%	70%
	large cobble	180	0	0%	70%
	very large cobble	256	0	0%	70%
Boulder	small boulder	362	0	0%	70%
	small boulder	512	0	0%	70%
	medium boulder	1024	0	0%	70%
	large boulder	2048	0	0%	70%
Bedrock	bedrock	40096	15	30%	100%
TOTAL % of whole count			50	100%	100%

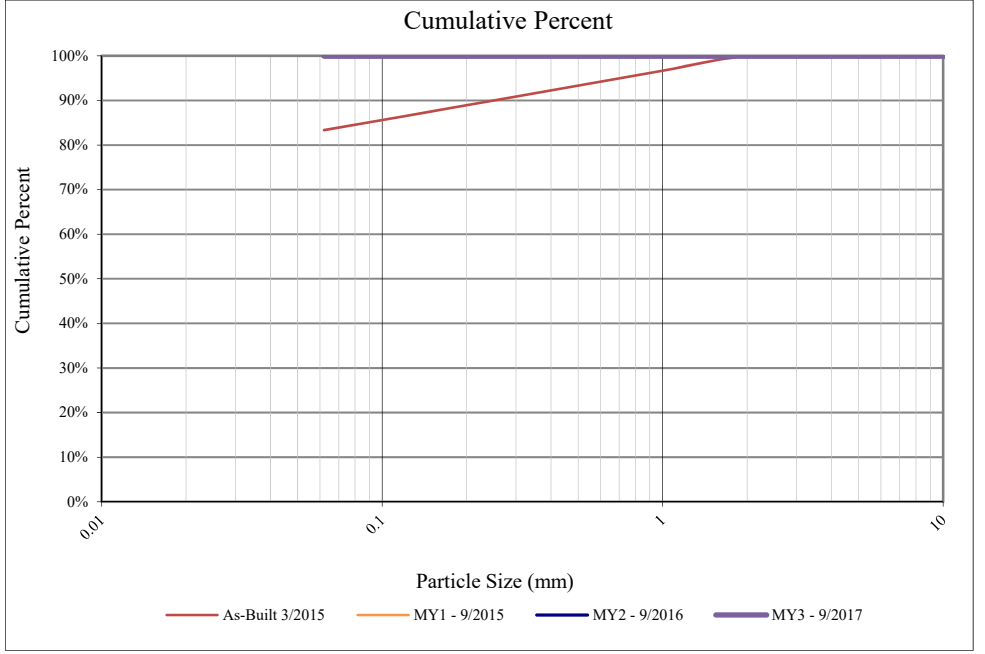
Summary Data	
D16	Silt/Clay
D35	0.83
D50	5.36
D84	Bedrock
D95	Bedrock
D100	Bedrock

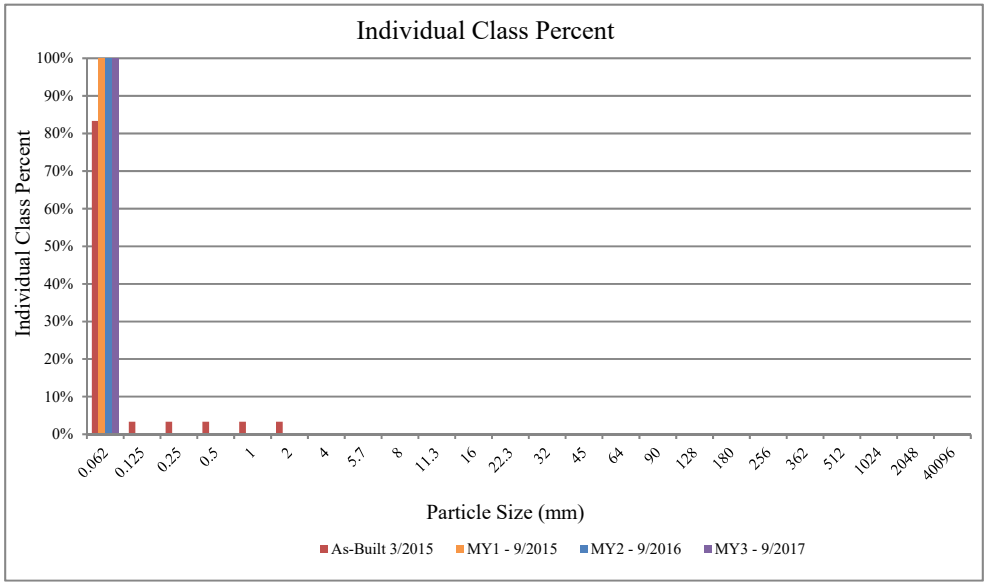




Project Name: Little Buffalo Creek					
Cross-Section: UT3-1R					
Feature: Riffle					
silt/clay/organic			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

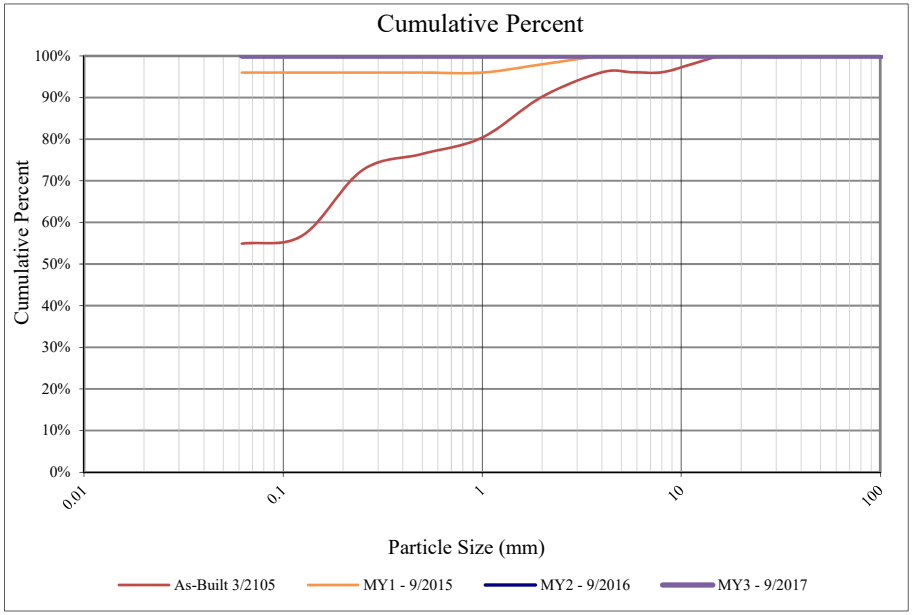
Summary Data	
D16	Silt/Clay
D35	Silt/Clay
D50	Silt/Clay
D84	Silt/Clay
D95	Silt/Clay
D100	Silt/Clay

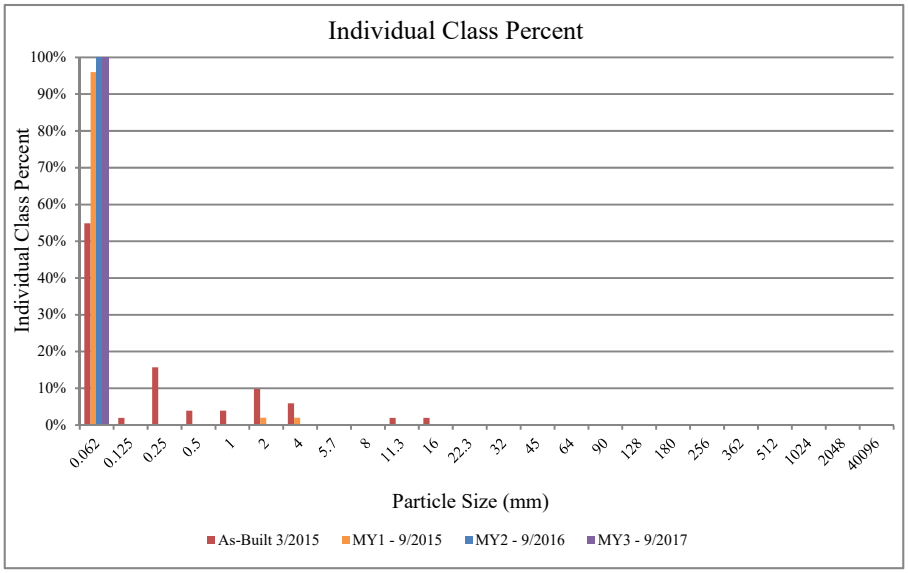




Project Name: Little Buffalo Creek					
Cross-Section: UT3-1P					
Feature: Pool					
silt/clay/organic			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

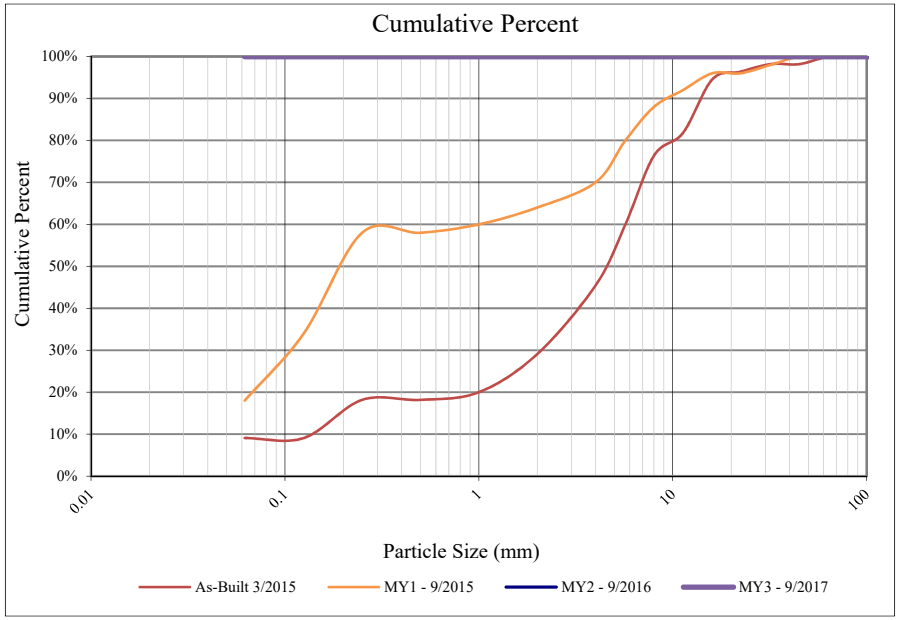
Summary Data	
D16	Silt/Clay
D35	Silt/Clay
D50	Silt/Clay
D84	Silt/Clay
D95	Silt/Clay
D100	Silt/Clay

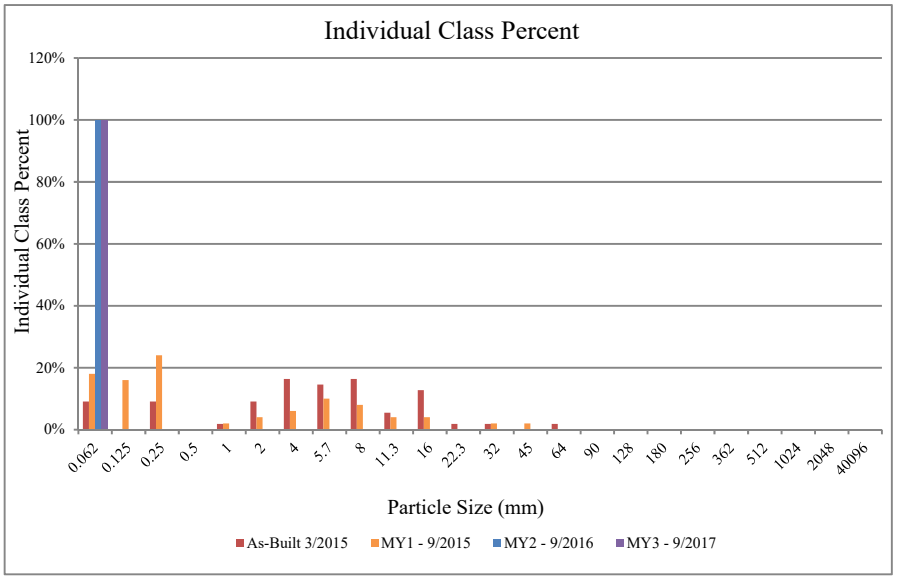




Project Name: Little Buffalo Creek					
Cross-Section: UT3-2R					
Feature: Riffle					
silt/clay/organic			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

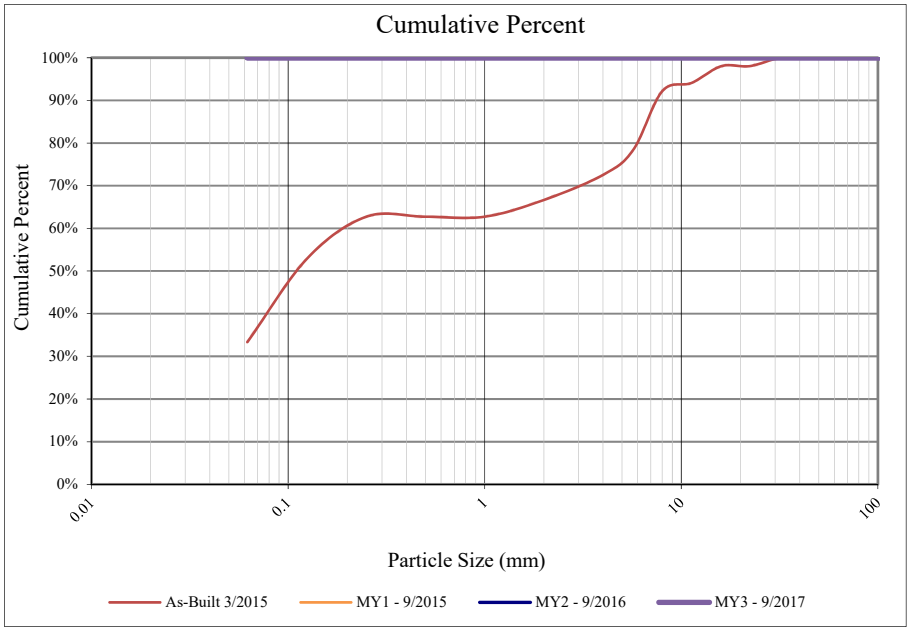
Summary Data	
D16	Silt/Clay
D35	Silt/Clay
D50	Silt/Clay
D84	Silt/Clay
D95	Silt/Clay
D100	Silt/Clay

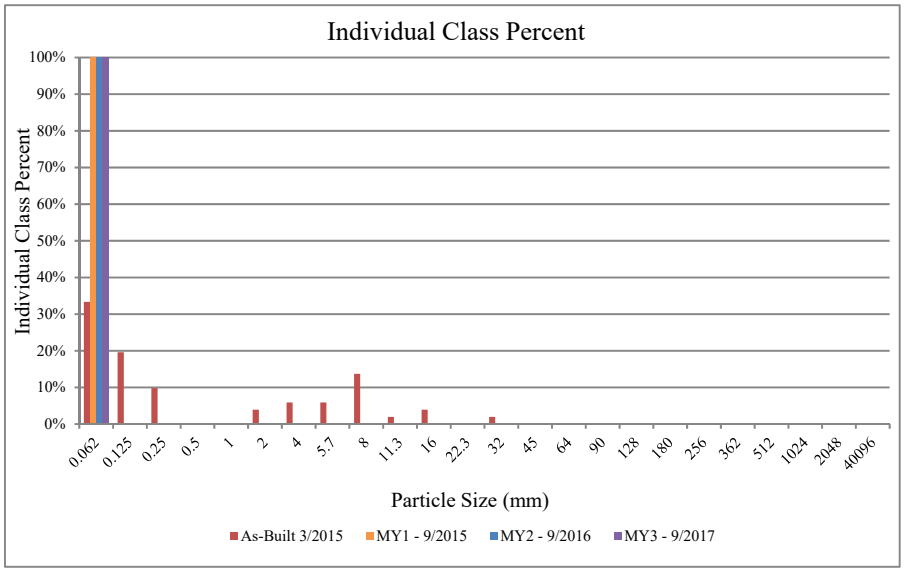




Project Name: Little Buffalo Creek					
Cross-Section: UT3-3R					
Feature: Riffle					
Silt/Clay/Organics			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

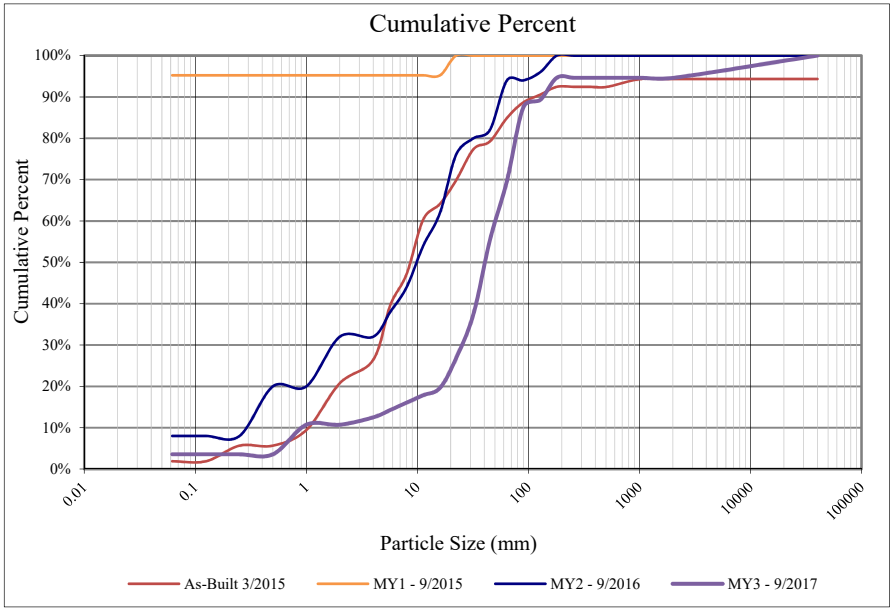
Summary Data	
D16	Silt/Clay
D35	Silt/Clay
D50	Silt/Clay
D84	Silt/Clay
D95	Silt/Clay
D100	Silt/Clay

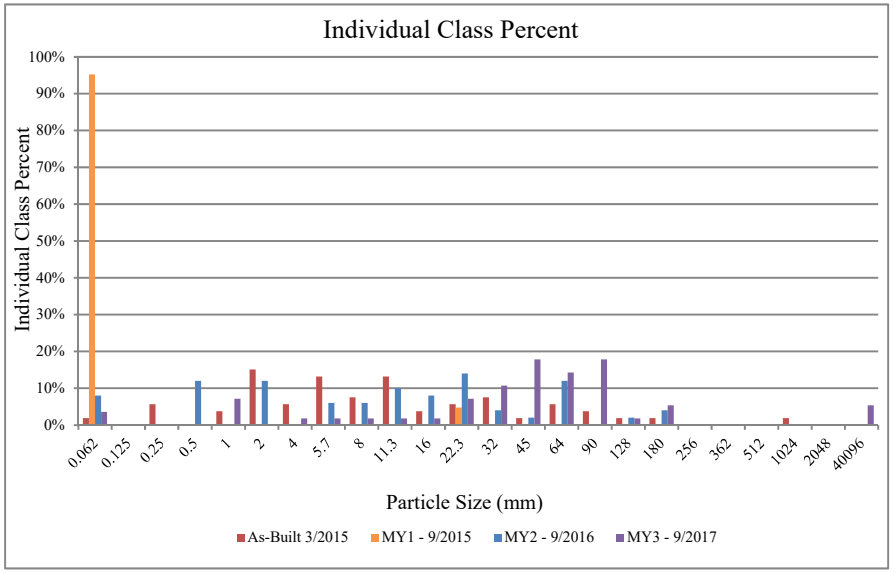




Project Name: Little Buffalo Creek					
Cross-Section: UT4-1P					
Feature: Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	4	7%	11%
	very coarse sand	2.0	0	0%	11%
Gravel	very fine gravel	4.0	1	2%	13%
	fine gravel	5.7	1	2%	14%
	fine gravel	8.0	1	2%	16%
	medium gravel	11.3	1	2%	18%
	medium gravel	16.0	1	2%	20%
	coarse gravel	22.3	4	7%	27%
	coarse gravel	32.0	6	11%	38%
	very coarse gravel	45	10	18%	55%
	very coarse gravel	64	8	14%	70%
Cobble	small cobble	90	10	18%	88%
	medium cobble	128	1	2%	89%
	large cobble	180	3	5%	95%
	very large cobble	256	0	0%	95%
Boulder	small boulder	362	0	0%	95%
	small boulder	512	0	0%	95%
	medium boulder	1024	0	0%	95%
	large boulder	2048	0	0%	95%
Bedrock	bedrock	40096	3	5%	100%
TOTAL % of whole count			56	100%	100%

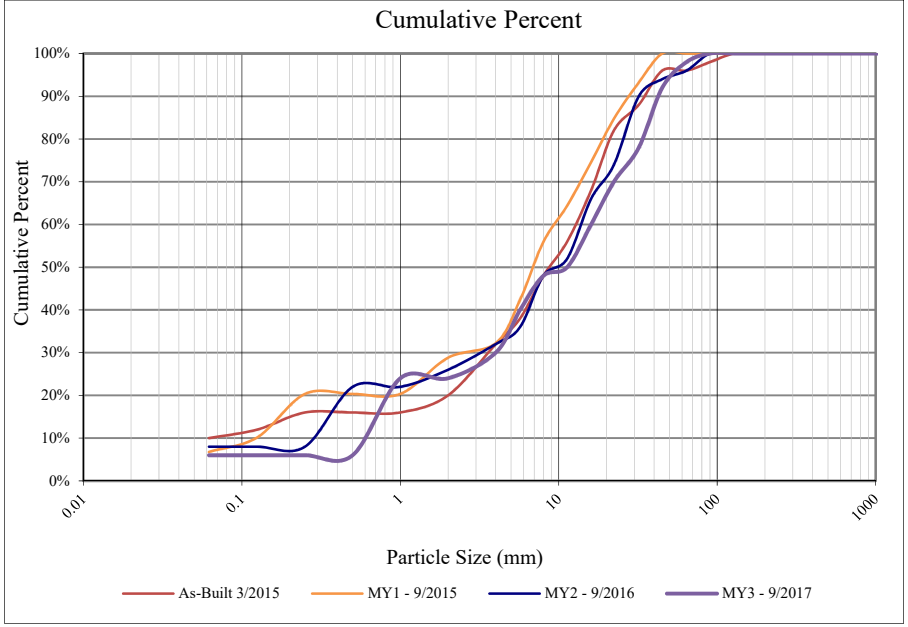
Summary Data	
D16	7.91
D35	29.74
D50	41.10
D84	84.90
D95	4584.50
D100	Bedrock

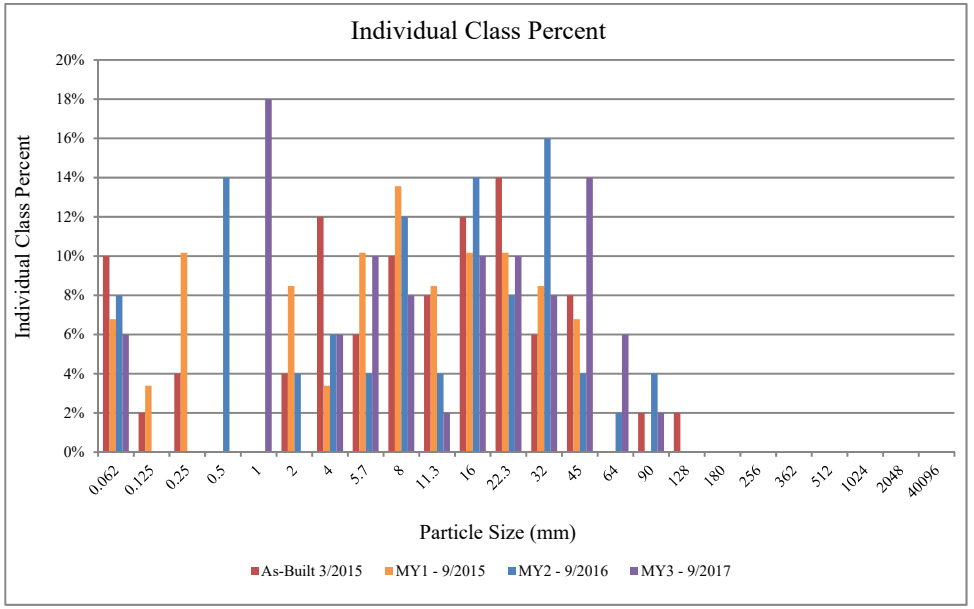




Project Name: Little Buffalo Creek					
Cross-Section: UT4-1R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	3	6%	6%
Sand	very fine sand	0.125	0	0%	6%
	fine sand	0.250	0	0%	6%
	medium sand	0.50	0	0%	6%
	coarse sand	1.00	9	18%	24%
	very coarse sand	2.0	0	0%	24%
Gravel	very fine gravel	4.0	3	6%	30%
	fine gravel	5.7	5	10%	40%
	fine gravel	8.0	4	8%	48%
	medium gravel	11.3	1	2%	50%
	medium gravel	16.0	5	10%	60%
	coarse gravel	22.3	5	10%	70%
	coarse gravel	32.0	4	8%	78%
	very coarse gravel	45	7	14%	92%
	very coarse gravel	64	3	6%	98%
Cobble	small cobble	90	1	2%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

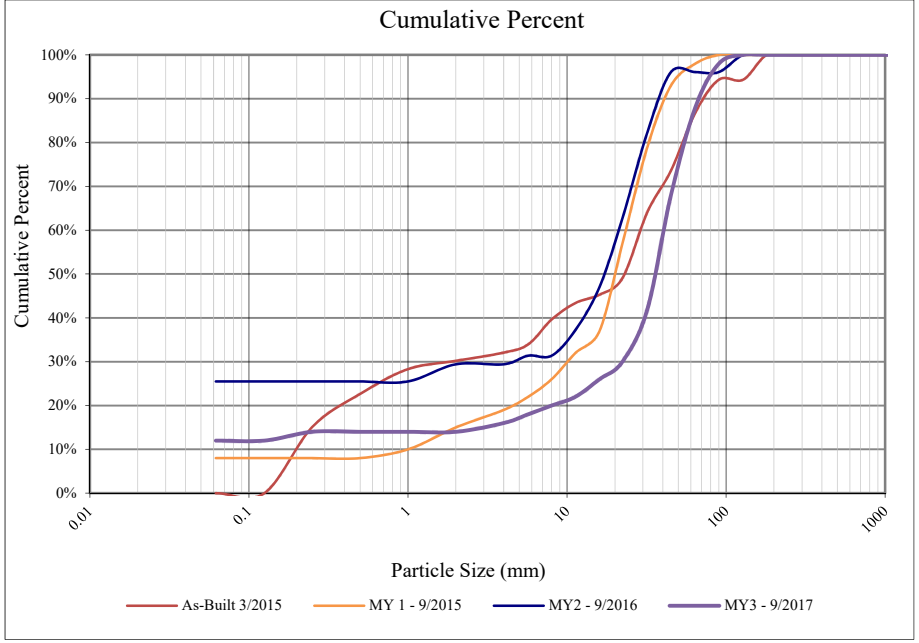
Summary Data	
D16	0.78
D35	4.85
D50	11.30
D84	37.57
D95	54.50
D100	90.00

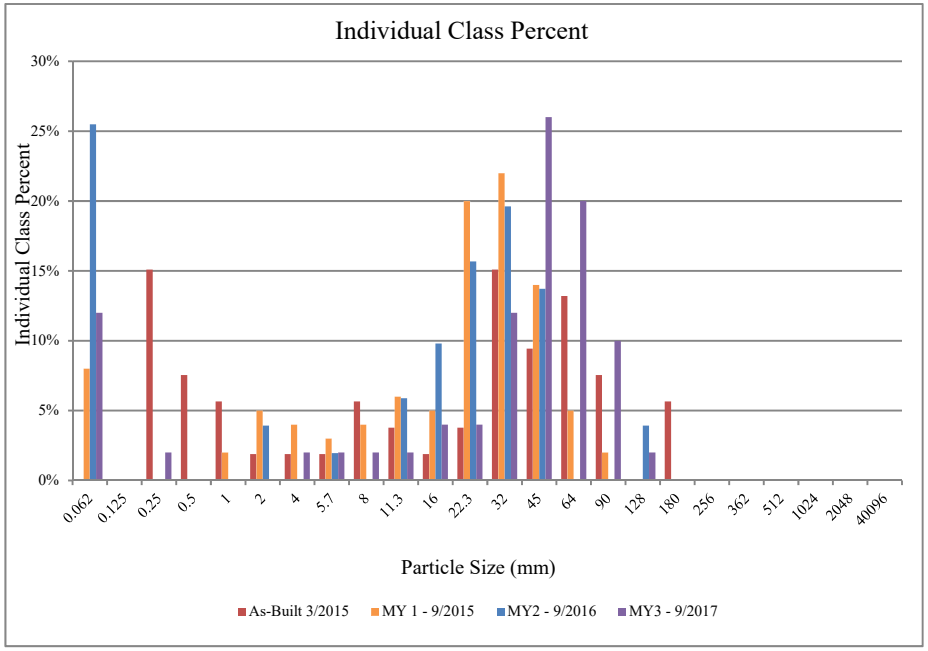




Project Name: Little Buffalo Creek					
Cross-Section: UT7-1R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	12%	12%
Sand	very fine sand	0.125	0	0%	12%
	fine sand	0.250	1	2%	14%
	medium sand	0.50	0	0%	14%
	coarse sand	1.00	0	0%	14%
	very coarse sand	2.0	0	0%	14%
Gravel	very fine gravel	4.0	1	2%	16%
	fine gravel	5.7	1	2%	18%
	fine gravel	8.0	1	2%	20%
	medium gravel	11.3	1	2%	22%
	medium gravel	16.0	2	4%	26%
	coarse gravel	22.3	2	4%	30%
	coarse gravel	32.0	6	12%	42%
	very coarse gravel	45	13	26%	68%
	very coarse gravel	64	10	20%	88%
Cobble	small cobble	90	5	10%	98%
	medium cobble	128	1	2%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

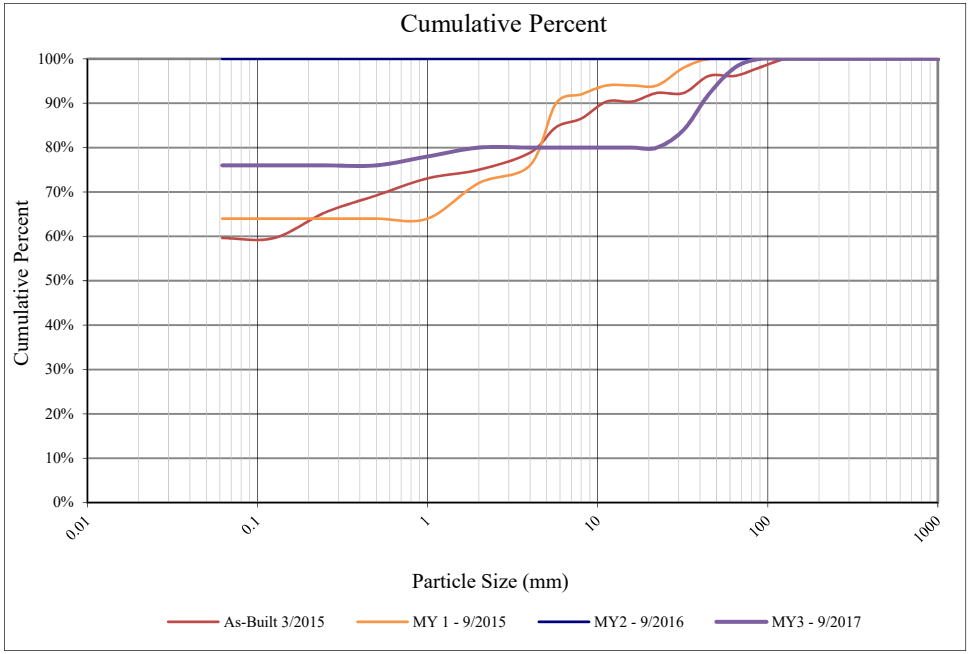
Summary Data	
D16	4.00
D35	26.34
D50	36.00
D84	60.20
D95	82.20
D100	128.00

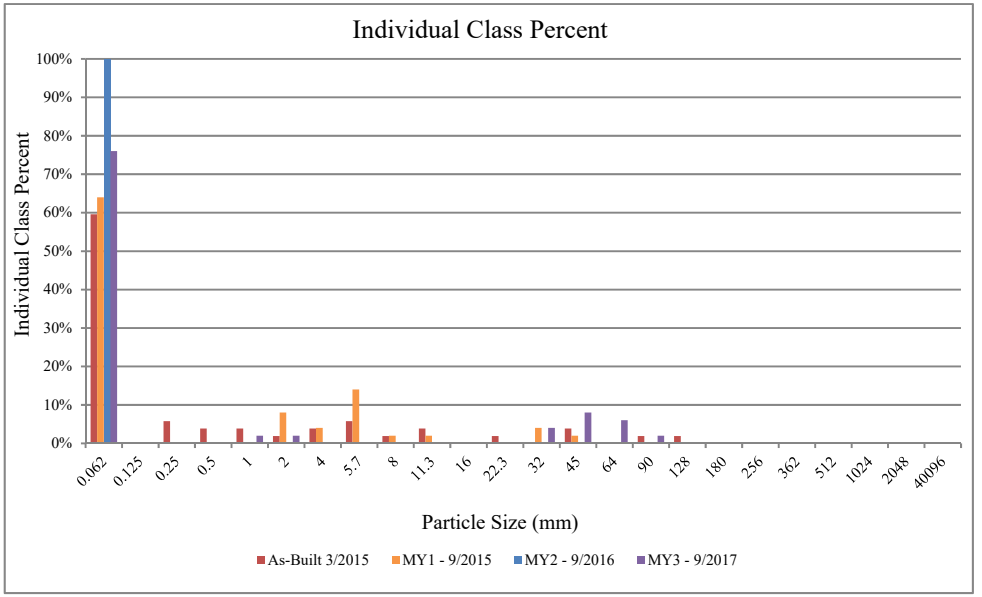




Project Name: Little Buffalo Creek					
Cross-Section: UT7-1P					
Feature: Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	38	76%	76%
Sand	very fine sand	0.125	0	0%	76%
	fine sand	0.250	0	0%	76%
	medium sand	0.50	0	0%	76%
	coarse sand	1.00	1	2%	78%
	very coarse sand	2.0	1	2%	80%
Gravel	very fine gravel	4.0	0	0%	80%
	fine gravel	5.7	0	0%	80%
	fine gravel	8.0	0	0%	80%
	medium gravel	11.3	0	0%	80%
	medium gravel	16.0	0	0%	80%
	coarse gravel	22.3	0	0%	80%
	coarse gravel	32.0	2	4%	84%
	very coarse gravel	45	4	8%	92%
	very coarse gravel	64	3	6%	98%
Cobble	small cobble	90	1	2%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

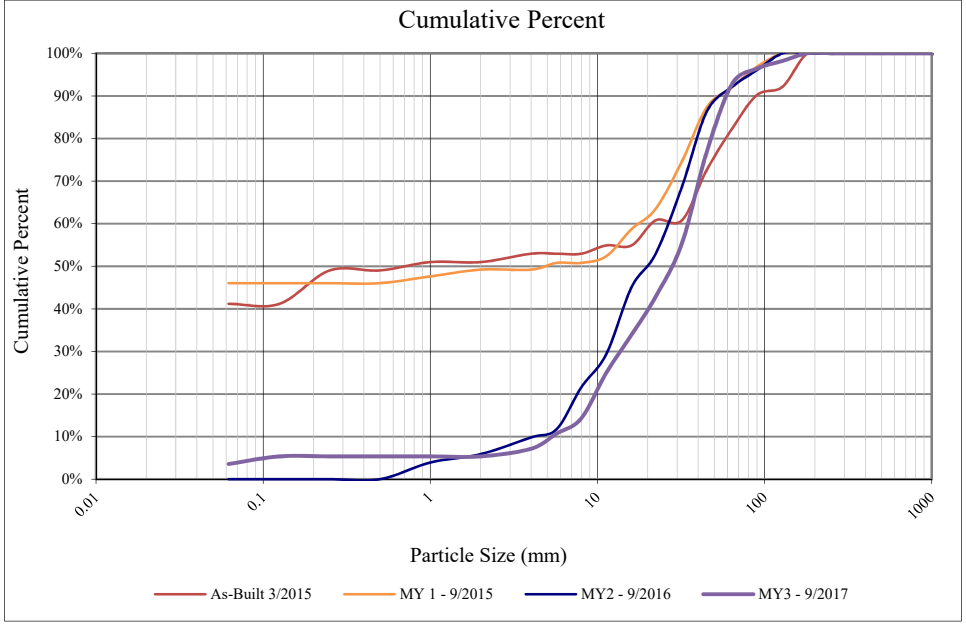
Summary Data	
D16	Silt/Clay
D35	Silt/Clay
D50	Silt/Clay
D84	32.00
D95	54.50
D100	90.00

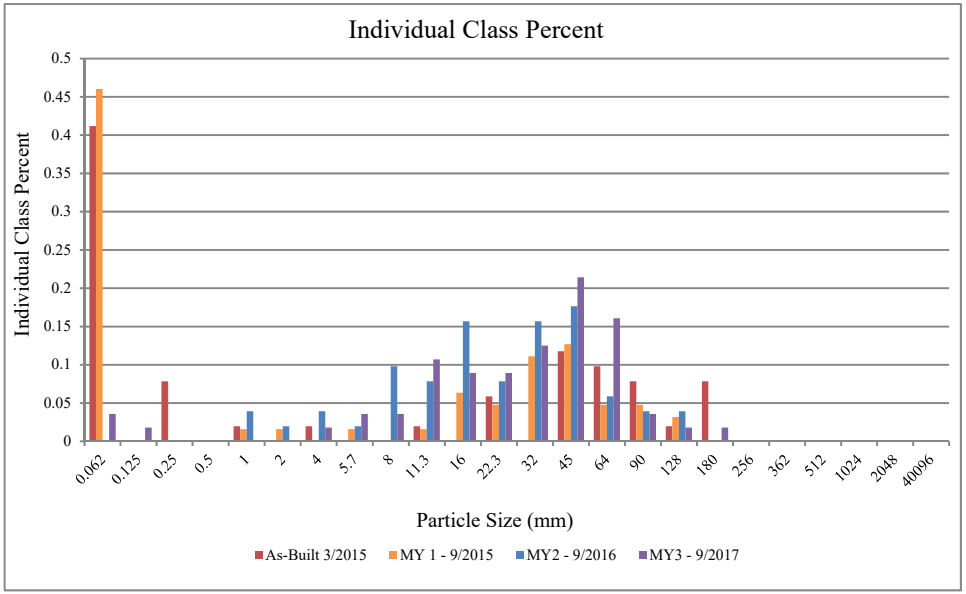




Project Name: Little Buffalo Creek					
Cross-Section: UT7-2R					
Feature: Riffle					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	4%	4%
Sand	very fine sand	0.125	1	2%	5%
	fine sand	0.250	0	0%	5%
	medium sand	0.50	0	0%	5%
	coarse sand	1.00	0	0%	5%
	very coarse sand	2.0	0	0%	5%
Gravel	very fine gravel	4.0	1	2%	7%
	fine gravel	5.7	2	4%	11%
	fine gravel	8.0	2	4%	14%
	medium gravel	11.3	6	11%	25%
	medium gravel	16.0	5	9%	34%
	coarse gravel	22.3	5	9%	43%
	coarse gravel	32.0	7	13%	55%
	very coarse gravel	45	12	21%	77%
	very coarse gravel	64	9	16%	93%
Cobble	small cobble	90	2	4%	96%
	medium cobble	128	1	2%	98%
	large cobble	180	1	2%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			56	100%	100%

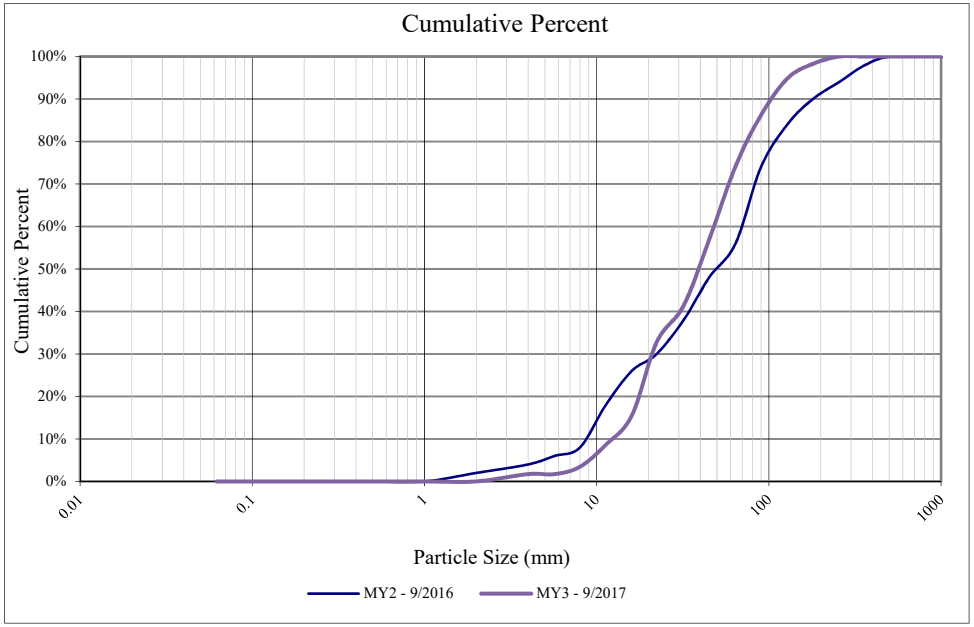
Summary Data	
D16	8.53
D35	16.76
D50	27.84
D84	53.53
D95	79.60
D100	180.00

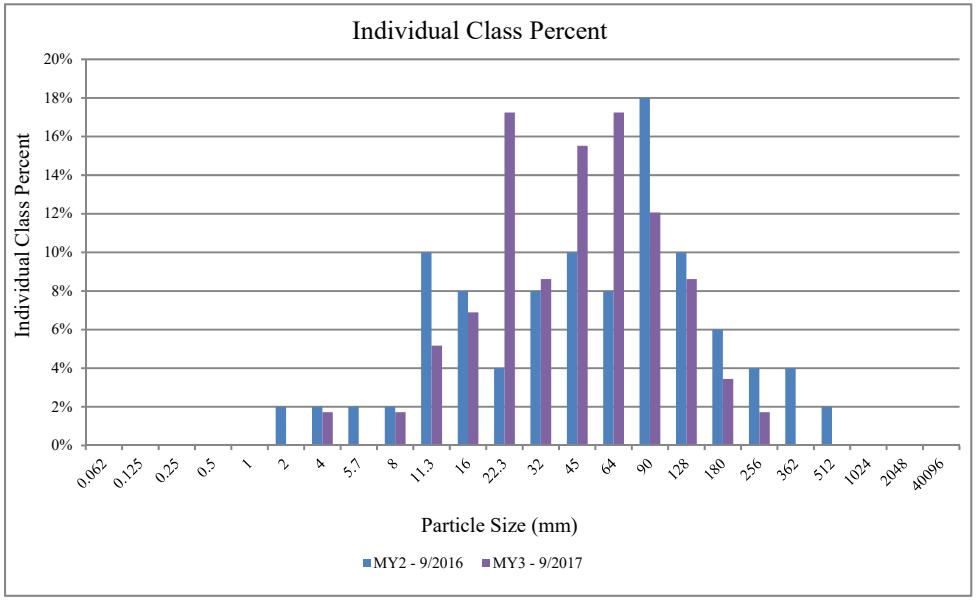




Project Name: Little Buffalo Creek					
Cross-Section: UT7-STP1					
Feature: Step Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	1	2%	2%
	fine gravel	5.7	0	0%	2%
	fine gravel	8.0	1	2%	3%
	medium gravel	11.3	3	5%	9%
	medium gravel	16.0	4	7%	16%
	coarse gravel	22.3	10	17%	33%
	coarse gravel	32.0	5	9%	41%
	very coarse gravel	45	9	16%	57%
	very coarse gravel	64	10	17%	74%
Cobble	small cobble	90	7	12%	86%
	medium cobble	128	5	9%	95%
	large cobble	180	2	3%	98%
	very large cobble	256	1	2%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			58	100%	100%

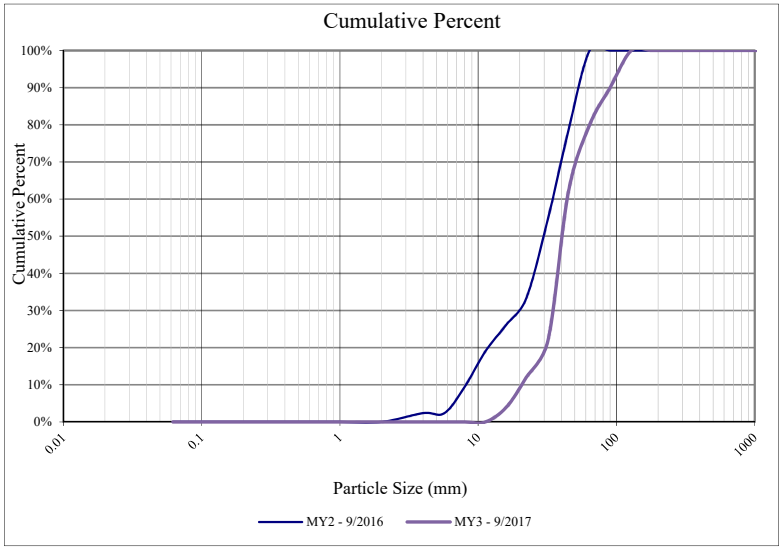
Summary Data	
D16	16.18
D35	24.82
D50	39.22
D84	85.25
D95	130.60
D100	256.00

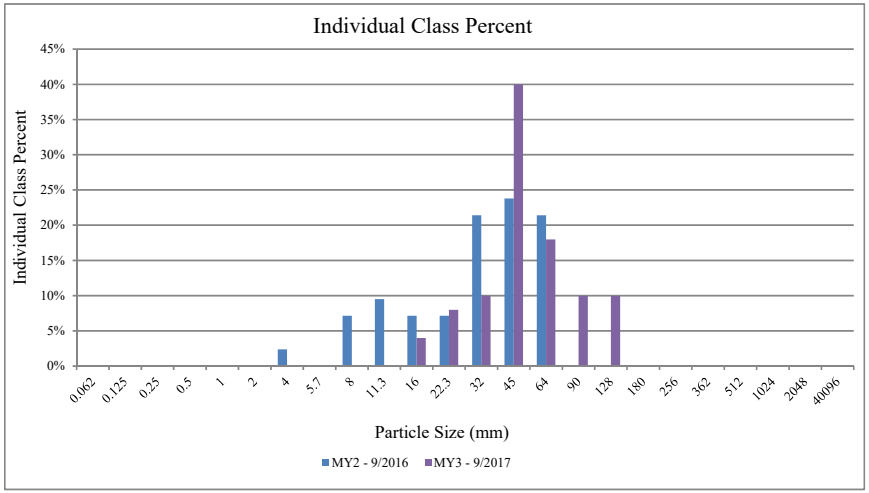




Project Name: Little Buffalo Creek					
Cross-Section: UT7-STP2					
Feature: Step Pool					
			2017		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	0	0%	0%
	medium gravel	16.0	2	4%	4%
	coarse gravel	22.3	4	8%	12%
	coarse gravel	32.0	5	10%	22%
	very coarse gravel	45	20	40%	62%
	very coarse gravel	64	9	18%	80%
Cobble	small cobble	90	5	10%	90%
	medium cobble	128	5	10%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

Summary Data	
D16	26.18
D35	36.23
D50	41.10
D84	74.40
D95	109.00
D100	128.00



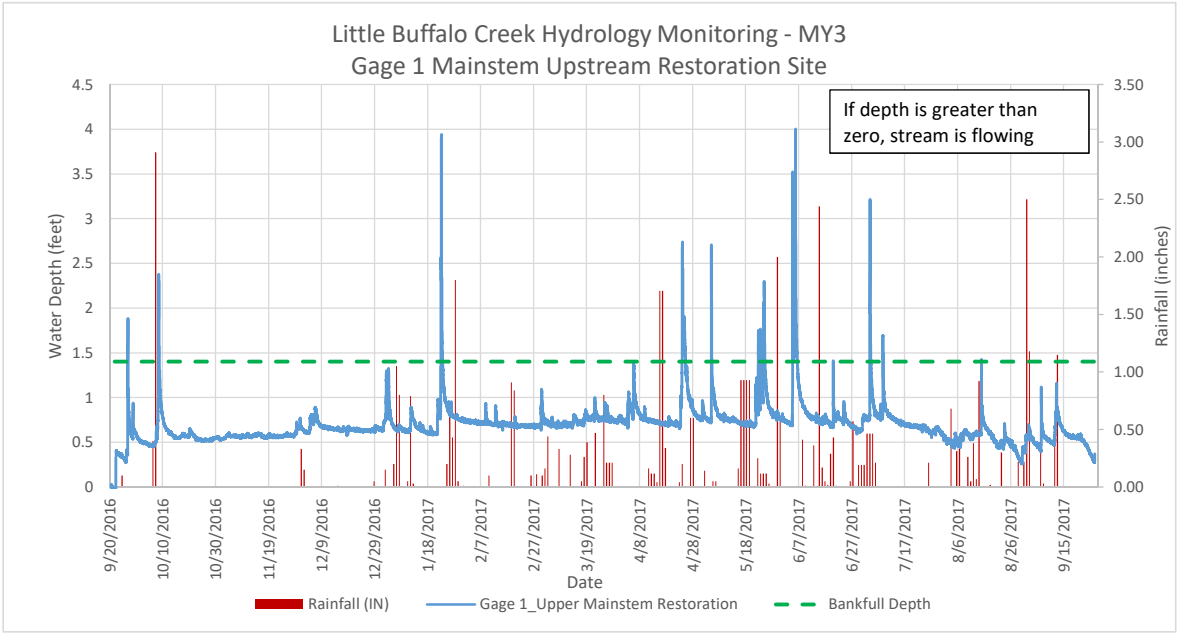


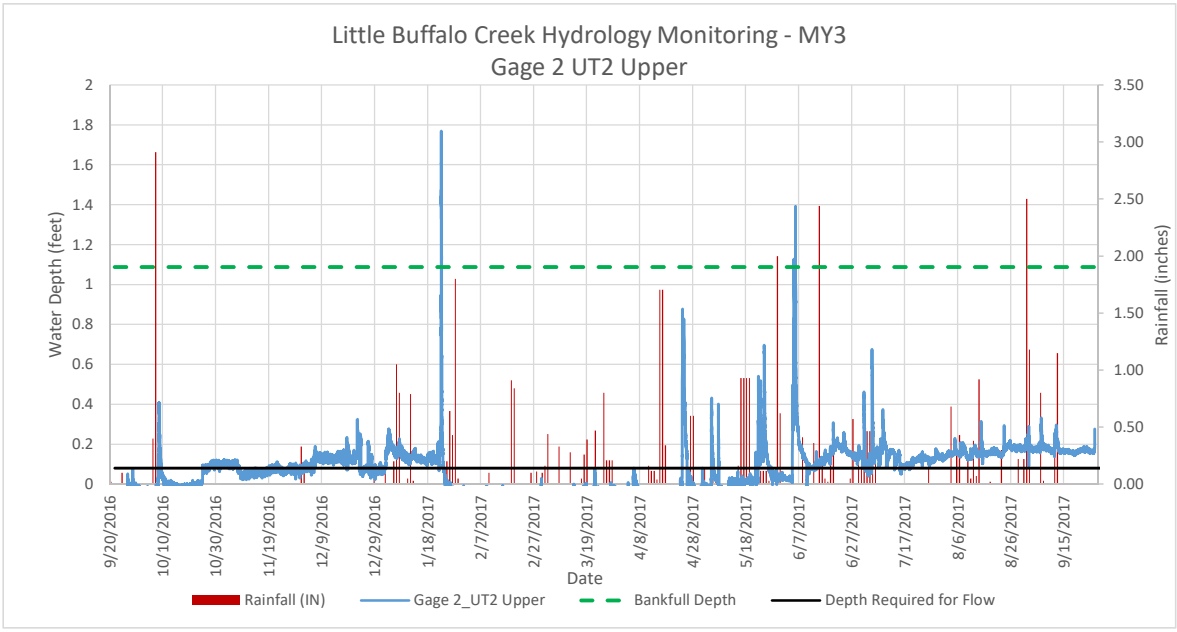
Appendix E – Hydrologic Data

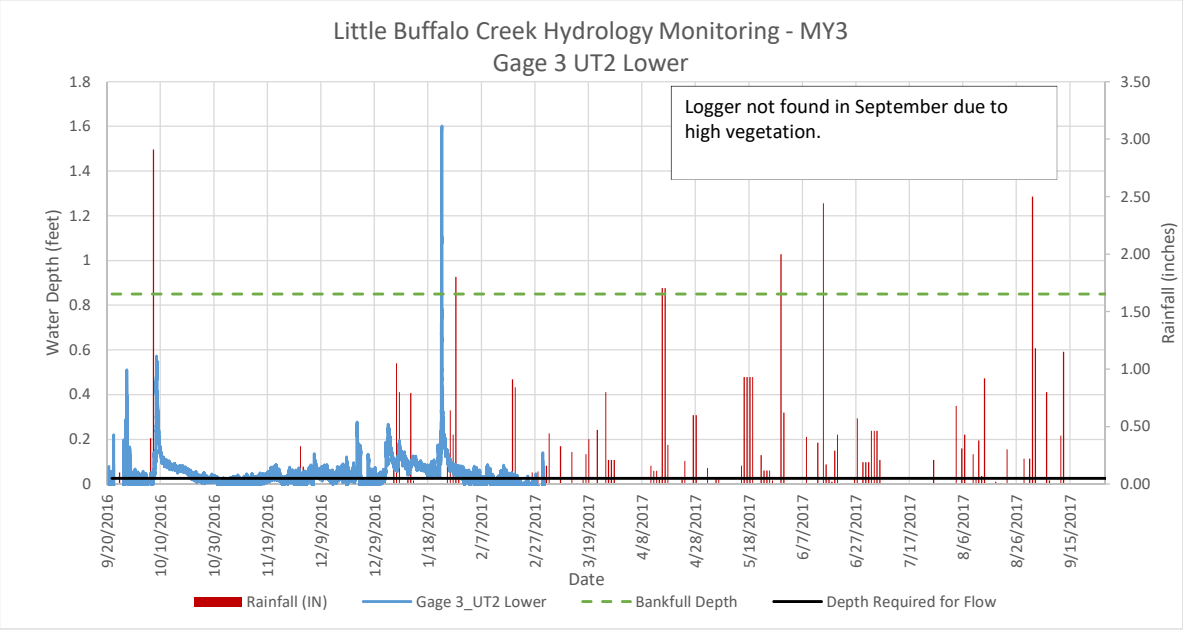
Table 12. Documentation of Geomorphologically Significant Flow Events					
Date of Observation	Date of Occurrence	Method	Greater than Qgs = Q2*0.66 stage?[1]	Greater than Qbkf Stage?	Notes
2/27/2016	11/9/2015	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
2/27/2016	12/22/2015	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
2/27/2016	12/30/2015	Surface Water Transducer Rack Lines	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations. See Photo Appendix.
9/19/2016	5/20/2016	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
3/2/2017	1/23/2017	Surface Water Transducer Rack Lines	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
9/18/2017	5/5/2017	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
9/18/2017	5/25/2017	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
9/18/2017	6/5/2017	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations

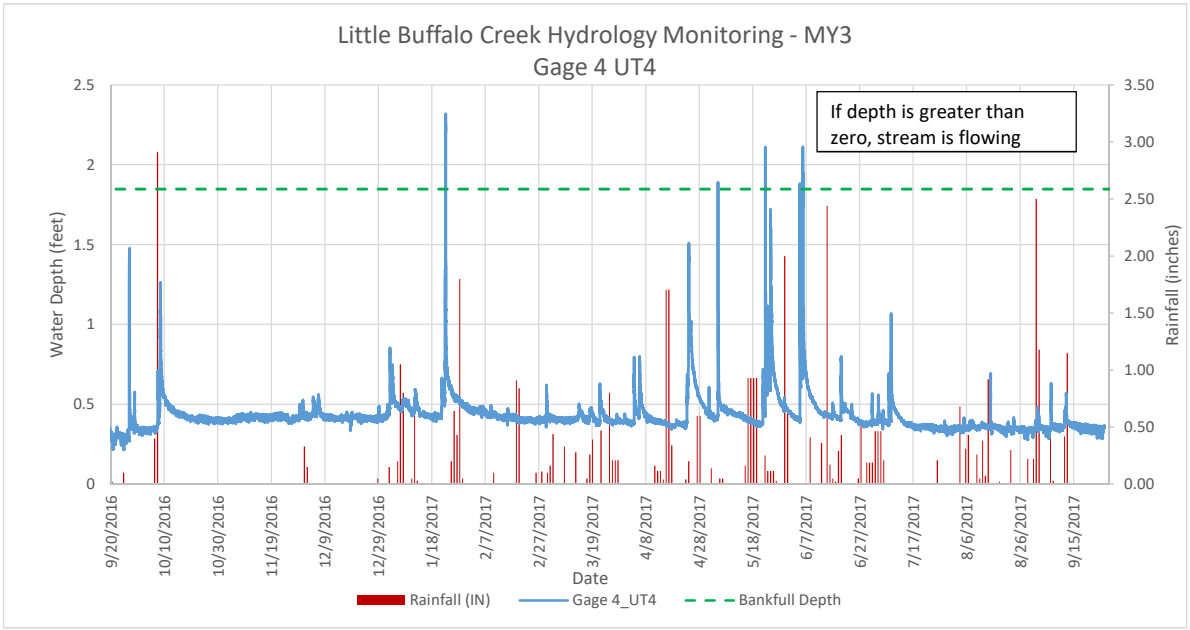
1) As stage relationships have not been calculated for the Qgs event, it is assumed that an event that has surpassed the identified bankfull stage on site also passed the Qgs event

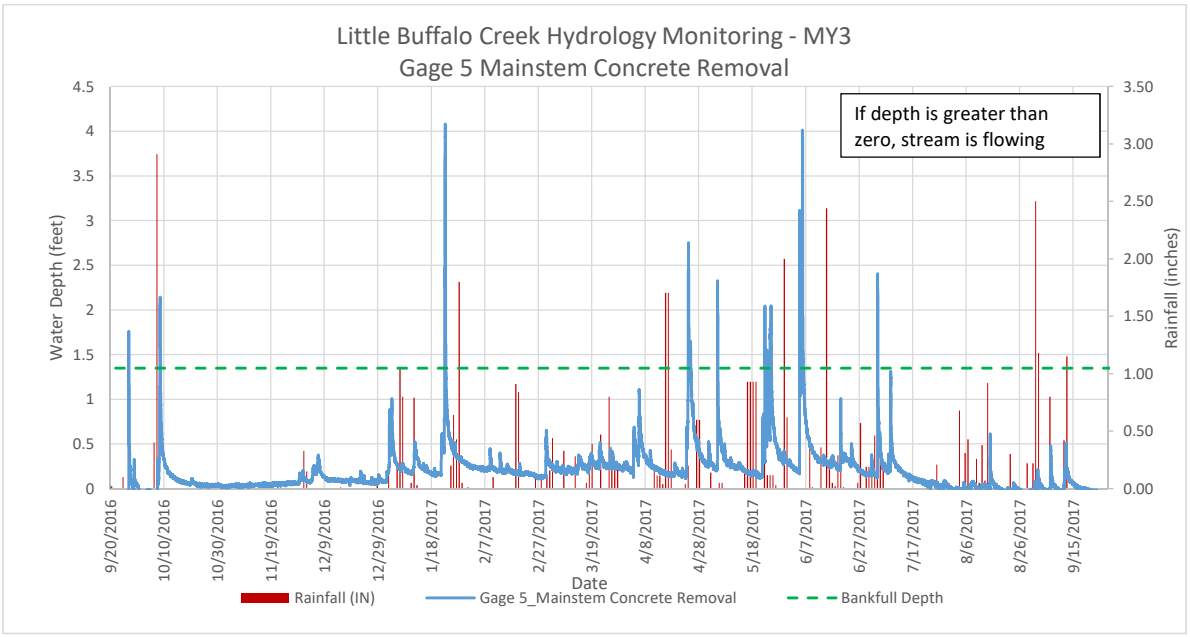
Figures 6a-e – Water Level and Rainfall Plots

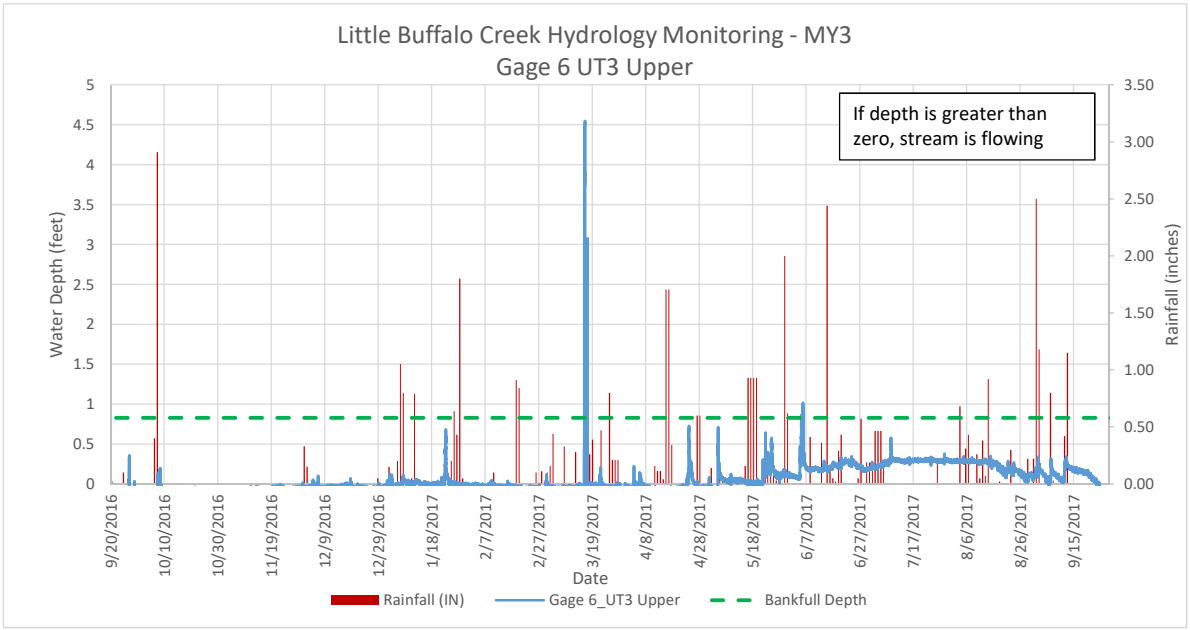

Little Buffalo Creek Hydrology Monitoring - MY3
Gage 1 Mainstem Upstream Restoration Site
If depth is greater than zero, stream is flowing
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 1_Upper Mainstem Restoration
Bankfull Depth

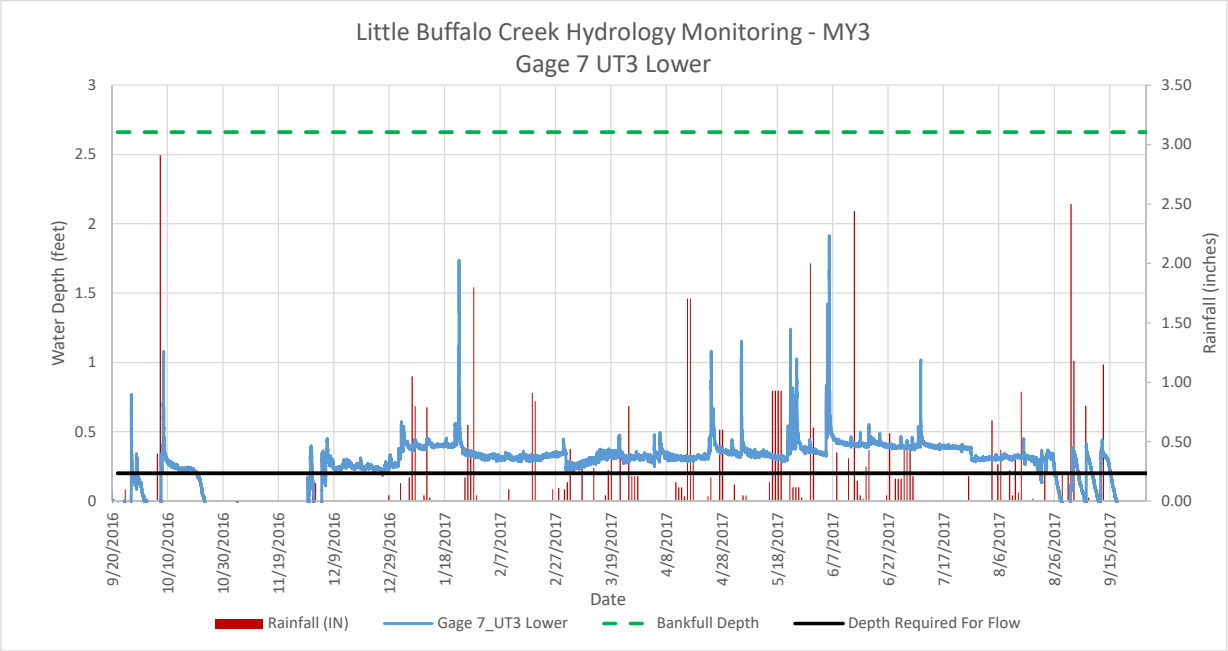

Little Buffalo Creek Hydrology Monitoring - MY3
Gage 2 UT2 Upper
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 2_UT2 Upper
Bankfull Depth
Depth Required for Flow

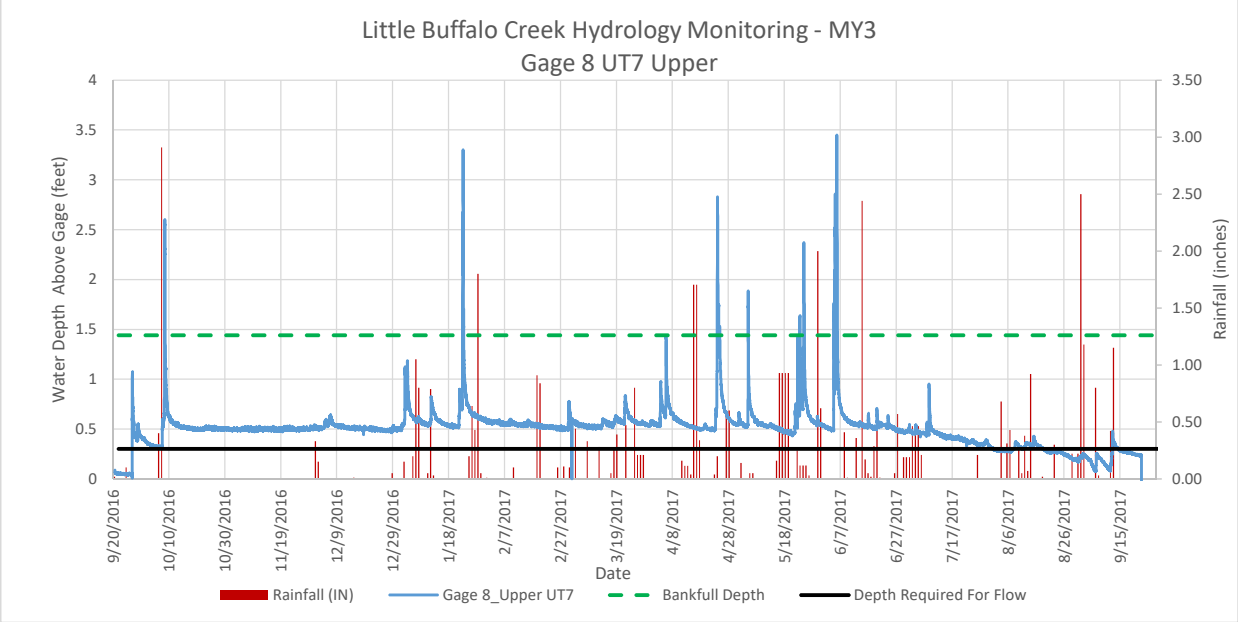

Little Buffalo Creek Hydrology Monitoring - MY3
Gage 3 UT2 Lower
Logger not found in September due to high vegetation.
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 3_UT2 Lower
Bankfull Depth
Depth Required for Flow

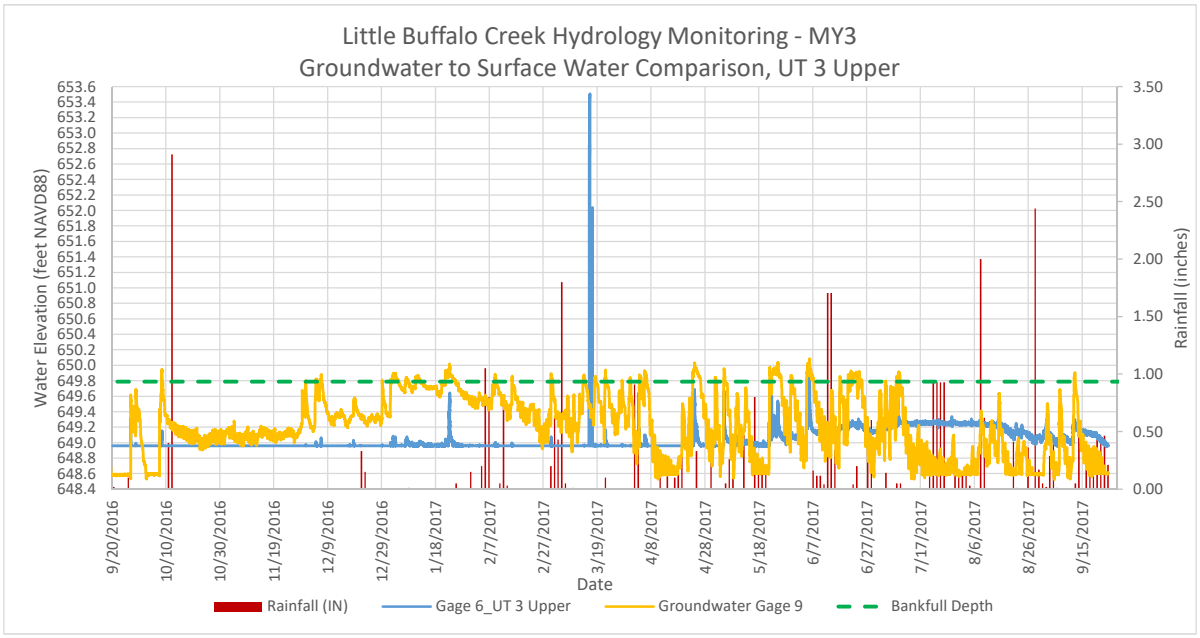

Little Buffalo Creek Hydrology Monitoring - MY3
Gage 4 UT4
If depth is greater than zero, stream is flowing
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 4_UT4
Bankfull Depth


Little Buffalo Creek Hydrology Monitoring - MY3
Gage 5 Mainstem Concrete Removal
If depth is greater than zero, stream is flowing
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 5_Mainstem Concrete Removal
Bankfull Depth


Little Buffalo Creek Hydrology Monitoring - MY3
Gage 6 UT3 Upper
If depth is greater than zero, stream is flowing
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 6_UT3 Upper
Bankfull Depth


Little Buffalo Creek Hydrology Monitoring - MY3
Gage 7 UT3 Lower
Water Depth (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 7_UT3 Lower
Bankfull Depth
Depth Required For Flow


Little Buffalo Creek Hydrology Monitoring - MY3
Gage 8 UT7 Upper
Water Depth Above Gage (feet)
Rainfall (inches)
Date
Rainfall (IN)
Gage 8_Upper UT7
Bankfull Depth
Depth Required For Flow


Little Buffalo Creek Hydrology Monitoring - MY3
Groundwater to Surface Water Comparison, UT 3 Upper
Water Elevation (feet NAVD88)
Rainfall (inches)
653.6
653.4
653.2
653.0
652.8
652.6
652.4
652.2
652.0
651.8
651.6
651.4
651.2
651.0
650.8
650.6
650.4
650.2
650.0
649.8
649.6
649.4
649.2
649.0
648.8
648.6
648.4
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
9/20/2016
10/10/2016
10/30/2016
11/19/2016
12/9/2016
12/29/2016
1/18/2017
2/7/2017
2/27/2017
3/19/2017
4/8/2017
4/28/2017
5/18/2017
6/7/2017
6/27/2017
7/17/2017
8/6/2017
8/26/2017
9/15/2017
Date
Rainfall (IN)
Gage 6_UT 3 Upper
Groundwater Gage 9
Bankfull Depth

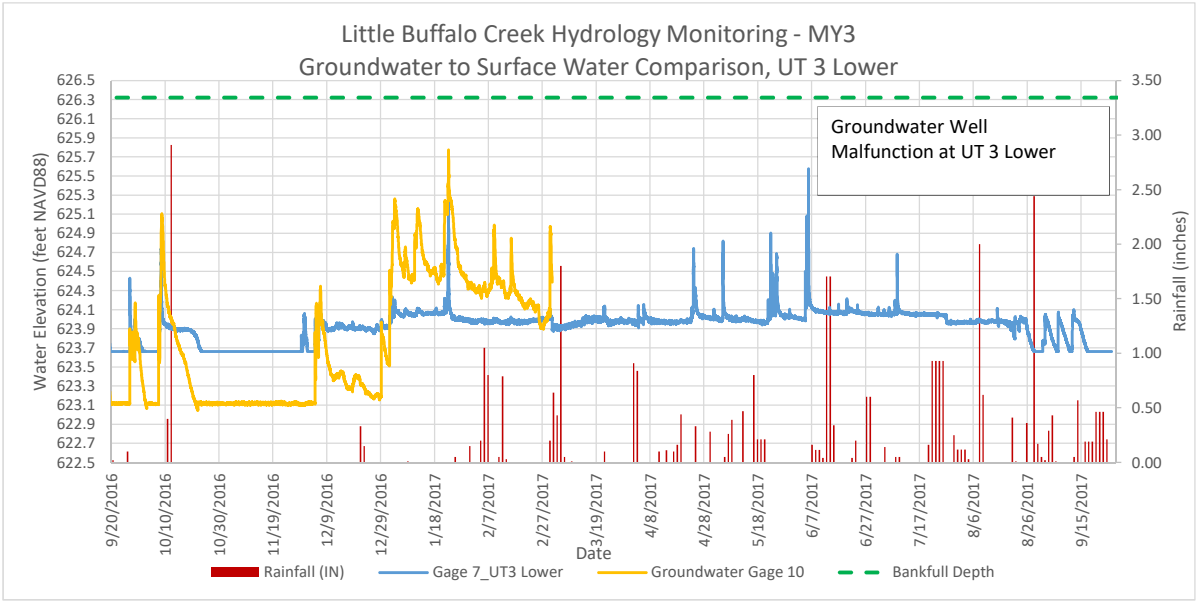

Little Buffalo Creek Hydrology Monitoring - MY3
Groundwater to Surface Water Comparison, UT 3 Lower
Groundwater Well
Malfunction at UT 3 Lower
Water Elevation (feet NAVD88)
Rainfall (inches)
626.5
626.3
626.1
625.9
625.7
625.5
625.3
625.1
624.9
624.7
624.5
624.3
624.1
623.9
623.7
623.5
623.3
623.1
622.9
622.7
622.5
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
9/20/2016
10/10/2016
10/30/2016
11/19/2016
12/9/2016
12/29/2016
1/18/2017
2/7/2017
2/27/2017
3/19/2017
4/8/2017
4/28/2017
5/18/2017
6/7/2017
6/27/2017
7/17/2017
8/6/2017
8/26/2017
9/15/2017
Date
Rainfall (IN)
Gage 7_UT3 Lower
Groundwater Gage 10
Bankfull Depth

Table 13 - Continuous Flow Record			
Gauge	Tributary	30-Day Continous Flow Met in Monitoring Period	MY 3 Period
1	LBC Reach 1	Y	9/22/16-9/26/17
2	UT 2 Upper	Y	7/19/17-9/26/17
3	UT 2 Low	Y	1/1/17-2/1/17
4	UT 4	Y	9/19/16-9/26/17
5	LBC Reach 4	Y	11/17/16-7/27/17
6	UT 3 Upper	Y	5/30/17-8/26/17
7	UT 3 Lower	Y	12/30/16-8/18/17
8	UT 7	Y	10/7/16-7/30/17

Note: Period listed for observed continuous flow is for the longest period of observed continuous flow based on hydrologic gauges at the project site. Additional periods of 30-day continuous flow are observed at individual gauges besides what is shown in the table.